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CONTENTS

EDITORIAL:
- Editorial Notes ... 375
- The Freight Rate Decisions ... 376
- Missouri Pacific ... 377

ILLUSTRATED:
- Havana Passenger Station ... 383
- Canadian Pacific Grain Elevator ... 384

MISCELLANEOUS:
- The Opinion in the Eastern Rate Case ... 378
- Opinion in the Western Rate Case ... 381
- Locomotive Smoke in Chicago ... 385

SHOP SECTION.

EDITORIAL:
- Editorial Notes ... 387
- The Failure of Locomotive Crown Sheets ... 388
- Efficiency ... 388
- Excessive Weights of Locomotive Machinery ... 389
- Mechanical Articles During February ... 390

ILLUSTRATED:
- Storehouse for Freight Car Material ... 393
- Car Inspectors' Kinks ... 395
- Brake Hanger Angles ... 397
- Increasing Shop Output ... 398
- Shop Kinks ... 403
- Prevention of Accidents in Shops ... 416
- Shop Improvements at Huntington, W. Va.; Chesapeake & Ohio ... 419

MISCELLANEOUS:
- The Mistakes of the Efficiency Men ... 391
- Boiler Shop Tool Room Practice ... 392
- How to Make a Time Study ... 396
- Locomotive Building in Europe ... 399
- Picked Up on the Road ... 402
- Piece Work Notes ... 402
- Car Interchange ... 414
- Foreign Railway Notes ... 401, 402, 422

GENERAL NEWS SECTION ... 423
SUPPLY TRADE SECTION ... 435

IN our issue of February 17 we printed a report on locomotive smoke in Chicago by Paul P. Bird, chief smoke inspector of that city, and in this issue will be found a discussion of that paper by C. A. Seley, in which the accuracy of some of the conclusions reached by Mr. Bird is questioned. The principal data which the inspector tried to obtain covers the amount of coal burned by the railways in the city and the percentage of the total smoke produced by them. The main conclusion reached by him was that although locomotives burn only 18½ per cent. of the coal they make 43 per cent. of the total smoke and over one-half the dirt in the city. Mr. Bird also says that his study indicates clearly that electrification offers the only final and satisfactory solution of the locomotive smoke problem, and that the use of special fuel for preventing smoke on steam locomotives is only a makeshift and will not satisfy the public. The railways are not satisfied that Mr. Bird's data is entirely correct. One of the principal reasons is that the time element has not been properly recognized in the calculations. While stationary boilers and house heating furnaces are consuming coal constantly and making smoke a large portion of the day and night, the locomotives are not constantly employed, and it is probable that the total number of engines reported in operation in the city are not in operation more than one-half the time. To take proper account of this time element would materially affect the figures given in Mr. Bird's paper and his conclusions as to the proportion of smoke chargeable to railways. Another objection to his figures is that it is not possible to obtain accurately the amount of coal burned by locomotives in the city limits, as the accounts are not kept with reference to such territory but rather to the local railway divisions which, as a rule, extend beyond the city limits. Mr. Seley also points out that the observations were made principally at junction points, where it is difficult to control locomotive fires and where it is probable that the largest amount of smoke is seen, and, therefore, maximum results are reported by the observer.

IF the question of electrification is to be decided on a showing relative to the proportion of smoke produced by the railways, it is important that the facts in the case be accurately and definitely determined. The Chicago smoke inspector has made an earnest effort to get at the truth. As the railways are not satisfied with his figures, it would seem they should take some measure to get at the facts with greater accuracy. Even if it can be shown that 43 per cent. of the smoke in Chicago is made by the railways it is not reasonable to require the roads to spend millions of dollars for electrification in order to stop that smoke while the owners of stationary boilers are allowed to continue making their usual proportion. It would be as reasonable to require that most of the stationary boilers and heating furnaces in Chicago be replaced by vast power houses for light, heat and power, while railway smoke was left unregulated. These agitations for smoke reduction should not look to electrification alone as a remedy for locomotive smoke, but the city should first seek, in co-operation with the railways, for a reduction in the amount of switching done in the city and in the number of freight trains entering and departing from it, and, consequently, in the number of engines which make smoke inside its limits. These things can be accomplished by the more general construction and use of outside yards and terminals, which would make the problem of electrification within the city limits much simpler. The people of Chicago should also carefully consider, before they take definite action requiring electrification, whether they are prepared to pay the price. The cost would be very great and, as it would be incurred entirely for the benefit of Chicago, in the long run the people of Chicago probably would have to, as they certainly ought to, bear a great part of it in the rates paid by them. Probably electrification in Chicago must come sooner or later; but it should not be required until a thorough investigation by experts shall be made, in which all parties interested shall be given full hearing and all of the important questions involved shall be rationally determined.

THE Idaho legislature, after a bitter debate in which a good many recriminations were bandied back and forth, refused last week to pass a bill to create a state railway commission. There are two interpretations which may be put on its action. One is that the people and law-makers of the state are not satisfied that the work of the commissions in neighboring western

states has been beneficial to the public. The other is that, in view of the fact that railway mileage in Idaho is small, they think public regulation should be deferred until it is larger. The latter interpretation seems, in the light afforded by the debate, to be the more nearly correct. Those who opposed the bill used language indicating that they believed the state should wait until it got more railways before beginning to regulate them; in other words, that it should wait until it catches its hare before beginning to skin it. The argument that seemed to carry the day was that adoption of a commission bill would prevent railway development. But, obviously, any measure which would now prevent railway development would, if passed later, do injustice to capital which hereafter may be invested in railways; for if regulation were reasonable and just it would not prevent railway development. The argument, then, that regulation ought to be postponed until the state gets more railways seems to resolve itself into a contention that it ought to get railways under false pretenses. The fact that even those who argued and fought against the bill opposed it on such a ground, or at least felt that they must give this reason for public consumption, well illustrates the unfortunate attitude toward capital invested in railways which is so generally assumed in the country west of the Missouri river. There seems to be only one way to change it, and that is to conduct the sort of educational campaign which the Oregon Short Line has been waging with success in Utah, Idaho, and other states along its lines during the last few years. That the educational work of the Oregon Short Line has contributed much toward the defeat of the Idaho bill there can be no question. Furthermore, it seems hard to believe, and we cannot believe, that it has not helped to create a much more intelligent sentiment regarding railway affairs than otherwise would have existed.

THE acquisition of half-control (the New York Central had 52 per cent. of the Rutland preferred, so the New Haven now owns 26 per cent.) of the Rutland Railroad by the New York, Hew Haven & Hartford has several significant points of interest. It is one of those rare, if not almost unprecedented, cases in American railway policy where two large railway systems have voluntarily joined in the control of a third system by the transfer of half of its interest by one of them; and in that aspect it seems to herald closer co-working of the New York Central and the New Haven. As the policy of the New Haven has been to equalize in itself the interests of its two chief allies, the Central and the Pennsylvania, one is not surprised now at the announcement that the long-delayed Hell Gate bridge connection (by which the New Haven gets direct rail connection with the Pennsylvania lines on Long Island) is to be pushed through; and it will be recalled that not long ago the Pennsylvania bought in a large block of New Haven treasury stock. Physical and traffic aspects of the Rutland deal are also suggestive. It gives to the New Haven, along with traffic rights, practically a line of its own from Southern New England to Montreal 16 miles shorter than the old route, with better grades for freight traffic, and invading Grand Trunk territory—this being somewhat of a counterstroke to the Grand Trunk's Providence plan. It opens a new rail and water route to the West via the Rutland's Ogdensburg branch and its fleet of Lake steamers; and it may be regarded especially as a new outlet westward for Boston and that large region of dense population and large factory product formed by eastern Massachusetts and southern New Hampshire. By closer examination of the railway map and the coming extension of the New Haven's White Plains branch to Danbury, Conn.—shortening by some 11 miles the route to the Berkshires—one can work out some other possibilities. For, in that case, a new line of only some eight miles to connect with the Rutland would give the New Haven an eligible route between New York City and Montreal. But such a project uses some miles of the Boston & Albany, and, as it cuts the New York Central's existing long haul to Montreal on the Hudson river route, it may be deferred for the present. Financially, what the New Haven undoubtedly looks for in its Rutland investment is a repetition of its striking Central New England experience—briefly, making a non-profitable system profitable by feeding it traffic from a bigger system. And, in that direction, reciprocity with Canada would be an important factor.

THE FREIGHT RATE DECISIONS.

THE decisions of the Interstate Commerce Commission in the rate advance cases came not merely as a surprise but as a shock to railway officials. Few expected that the commission would grant all the advances sought, but almost no railway man doubted that it would permit some. The immediate effects on business, of course, may not be as bad as many fear. During the period of uncertainty about what the commission would do, railway managers postponed numerous expenditures which were really needed. It seems probable that they will within the next few months place many delayed orders. So far as can be learned, no orders for equipment have been cancelled, and prices of railway stocks have recovered within one or two points from the sharp break which followed the announcement of the decisions. Also, it is probable that the immediate effects will be good in that unreasonable demands for lower rates and higher wages will not get the public support they have had heretofore.

But it is impossible for us to be optimistic about the ultimate effects of the decision. It is a long step toward government ownership. Railway executives such as Presidents Ripley, Brown, McCrea and Willard went on the stand and swore they believed that the rates the railways desired to make were reasonable, and that the roads needed increased revenue which could be secured only through higher rates. Although in the course of the two opinions the commission repeatedly says that it does not want to take the management out of the hands of the present managers, still it seems to place less reliance on the business judgment of these railway men than on its own opinion.

Throughout the commission's history, railway managers have regarded it as being unfair to the roads. Before the passage of the Hepburn act, successful appeals from its decisions were repeatedly made. They hoped that its experience of numerous defeats in the courts and the increased powers given it by the Hepburn and Mann-Elkins acts would increase its sense of responsibility, conservatism and fairness. The decisions in these cases tend to dissipate such hopes. They indicate that the commission is not equal to the responsibility put on it. If it had considered these cases with an eye only to the greatest good to the whole country it could not, if it felt any reasonable doubt as to whether or not the increases were justified, have done otherwise than to grant them. The loss to the shippers would be much less than the gain to the whole country, including these same shippers, accruing from the extensive purchases of material and supplies which the railways would have made in the event of a favorable decision.

In face of the fact that the efficiency with which American railways have been managed has been one of the modern wonders of the world, the commission reflected on their management by saying that "Before any general advance can be permitted, it must appear to a reasonable certainty that carriers have exerted proper economy in the purchase of their supplies, in the payment of their wages," etc. However, in both decisions the extravagant Brandeis claims were belittled. The suggestion that railways must prove proper economy in wages raises the question as to whether the commission thinks the roads have been improvident in increasing wages, and will co-operate with them in resisting future unreasonable demands regarding wages and conditions of employment. It never has done so. Every member of the commission who has arbitrated a labor dispute has given higher wages. The commission's remark implies a demand for greater economy in operation; the public constantly demands the improvement of service. Between these upper and nether millstones there

is danger that any reasonable profit to the stockholders will be ground pretty fine. If the economies suggested were practiced, the result would be apt to be that the public would not get the service it demands and that labor would be dissatisfied. While, as the commission says, earnings in the *fiscal* year 1910 were the largest in history, railway men have felt that figures for the *calendar* year 1910 tell a different story. In the first six months of the calendar year, net revenue increased 6.8 per cent.; in the last six months of the calendar year net decreased 6.6 per cent. The difference was caused mainly by wage increases. The total operating revenues during the calendar year increased about $216,000,000, leaving an apparent net increase of $4,200,000; but if this be apportioned on the basis of increased mileage it shows a net decrease of $40 per mile. Of the increase in operating expenses, $122,000,000 was due to conducting transportation, in which wages constitute the largest item. The commission refused to consider these recent figures, saying that the period covered was too short to have a bearing on the question. Aside from the question of accounting (monthly statements cannot agree with averages arrived at after a full year's figures are available for examination) these recent statements do not necessarily indicate a continued decline in net earnings. For instance, when the movement for increased rates began, earnings were on the decline and there seemed to be good reason to fear a long pull of decreased revenue; yet the year 1910 proved to be one of the most prosperous in railway history.

The law puts on railways the burden of proving that any higher rates they propose are just and reasonable. The roads sought to show, first, that the rates they proposed would be reasonable and, second, that they needed to make advances in order to earn enough money to pay fair dividends and give good service. The commission, though not in so many words, admits that specific increases asked for were reasonable in themselves, but it really decided the cases on the basis of earnings and credit. It confined itself to the question of whether or not the roads' need of money was so great as to require an increase in rates. Accepting this as a basis for judging rates (and the commission, it seems, cannot out-grow its idea that there is such a thing as a "theory" of rate making by which all rates can be regulated) it studied the earnings of the stronger roads. It held that advances ought not to be made because, while weaker lines needed them, stronger lines did not. For fear that some might be made unnecessarily prosperous others must continue to suffer adversity. Though the commission is criticised for this, it could not have done otherwise in the premises. If a weak road is taken as the basis and its rates raised so as to allow it to earn dividends (and, of course, rates of stronger competing lines raised also) it would amount to a tax on the public throughout the territory affected in order to subsidize a road weak through unfavorable location or bad financing. The impression that its decision was based solely on the theory that even the more prosperous roads should not be allowed to earn more than the so-called fair return is supported by this statement in Commissioner Prouty's opinion in the eastern rate cases: "There is no testimony tending to show the cost of reproducing these properties. It is plain that physical valuation would introduce into the calculation a new element which might lead to a different conclusion." Neither the United States Supreme Court nor any other court of competent jurisdiction has held that physical valuation is a proper basis for calculating the reasonableness of an entire schedule of rates. In the case of Smythe *vs.* Ames, the Supreme Court specifically held that the market value of stocks and bonds, density of traffic, operating expenses, and other factors affecting value as a going concern must be considered. In Cotting *vs.* Godard it specifically said that a public service corporation is entitled to reasonable compensation for each service, and that it never had held that rates might be so regulated as barely to avoid confiscation. Yet apparently in these cases the commission definitely committed itself to the theory that rates, as a whole, should be so regulated as to restrict stronger railways to comparatively small return.

The railways have apparently decided to accept the commission's decision and try to work out their salvation under existing rates. This certainly will afford the best test as to whether commission or the managers are right in their opinions of railway needs. If the commission turns out to be wrong, both the roads and the public suffer much more than if the commission had granted advances and subsequent developments had shown them unnecessary. The roads might take the commission's hint and demand valuation as a means of demonstrating, in the only way that apparently will satisfy the commission, that railways are not earning fair return. This would be dangerous because in the eyes of the public it would commit them to acquiescence in a policy of regulating rates on the basis of valuation.

The extent of the commission's authority under existing laws, whether or not it has exceeded that authority, the constitutionality of present laws and the extent of control over railway rates and profit which Congress itself may exercise or delegate to the commission are all unsettled questions. The decisions in these cases show that the commission is committing itself to a theory of regulation which railway managers cannot accept and, at the same time, try to keep faith with their stockholders. It is only a matter of time until the question as to whether the public management of public utilities while they continue to be private property is constitutional must be litigated for final settlement. These decisions of the commission have brought this litigation nearer, and it would seem that, since it is inevitable, the sooner a case directly presenting the great issues involved is got on its way to the Supreme Court the better it will be for all concerned. The existing uncertainty about public's power and stockholder's rights is calculated to steadily discourage development not only of railway business but of all businesses directly or indirectly affected.

MISSOURI PACIFIC.

IT is as an indication of what the Missouri Pacific should be able to do, rather than as a record of what has been done in the past, that the company's report for the fiscal year ended June 30, 1910, is of especial interest. Before, however, an examination is made of the condition of the property, as indicated by the report, and of traffic possibilities, as forecast by last year's showing, it is important to see what arrangements the Missouri Pacific has made for financing future additions and betterments. In 1909 the finances of the company were reorganized and a new mortgage made for $175,000,000. In addition to this a mortgage for $25,000,000 was placed on the St. Louis, Iron Mountain & Southern. The two properties are treated as one in discussing the results of operation. Under the Missouri Pacific mortgage $29,806,000 5 per cent. convertible bonds were issued. Of this amount, $19,700,000 was partly for refunding outstanding bonds and paying floating indebtedness, and under the terms of the mortgage it was provided that $4,653,250 out of the proceeds of this $19,700,000 should be deposited with the railway company to pay for improvements and additions. In addition there were $4,640,500 sold for improvements and additions. This makes a total of $9,293,750. Under the terms of the mortgage $85,993,000 were reserved for refunding bonds and $19,700,000 were reserved to exchange for St. Louis, Iron Mountain & Southern bonds. The remaining $5,300,000 St. Louis, Iron Mountain & Southern bonds out of the total issue of $25,000,000 having been issued to provide for betterments. This leaves, therefore, $52,866,500 bonds which may be issued for additions and betterments to the Missouri Pacific, and $19,700,000 which may be issued for additions and betterments to the Iron Mountain, a total of $72,566,500. In addition, there are $6,500,000 refunding bonds reserved to retire equipment notes. Since these refunding bonds are selling in the neighborhood of 95, this arrangement for the issue of new bonds gives the Missouri Pacific and the Iron Mountain a satisfactory means of raising the new capital that is so badly needed for improvement of the physical property.

In the fiscal year ended June 30, 1910, the Missouri Pacific system spent $8,000,000 for additions and betterments, the two largest items being $1,970,000 for ballast and $1,230,000 for additional main track. The company also spent $470,000 for new equipments and improvements to equipment, in addition to the amount ($706,000) credited to property account through the sale or destruction of old equipment.

In 1910 there was 185 miles of new 85-lb. rail laid in track, partly on the main line between Omaha and Kansas City, and partly on the main line between Kansas City and St. Louis and on the lines in Kansas. On June 30, 1910, there was over 2,200 miles of main track laid with 56-lb. rail and 414 miles laid with 52-lb. rail, while 1,861 miles of main track was laid with 85-lb. rail. This exhibit alone shows strikingly how much will have to be spent on the improvement of the property before it can be put in the same class with such competitors as the Santa Fe. There are still 21 miles of iron rails in main track.

During the fiscal year 1910 a total of 691 miles of track was ballasted with gravel and 20 miles with rock. Of the total system in operation on June 30, 1910, 2,555 miles was unballasted, something over 1,800 miles ballasted with gravel, and over 900 miles with cinders. If the passenger department of the Missouri Pacific is to have a fair show at competitive business, a great deal of track now unballasted will have to have either good gravel ballast or rock.

The increase in operating expenses was about evenly divided between transportation and maintenance; but the transportation expenses are as high as they should be now, while maintenance expenses may need to go even higher, although the following table showing the unit costs of maintenance would seem to indicate that last year the Missouri Pacific spent large sums on maintenance:

	1910.	1909.
*Maintenance of way per mile	$1,995	$1,098
†Repairs per locomotive	2,858	2,971
Repairs per passenger car	1,130	1,040
Repairs per freight car	81	64

*Per mile of main and branch line tracks, no account being taken of sidings and switch tracks.

†Repairs only, no allowance being made for renewals, depreciation or overhead charges.

The traffic department of the Missouri Pacific is good. It has plenty of handicaps to work under, but the geographical position of the Missouri Pacific and its terminal facilities, especially on its roads running out of St. Louis, gives the traffic department a naturally strong position in competing for business. In 1910 there were 11,400,000 passengers carried, an increase of 6 per cent. over 1909. The average distance, however, that each passenger was carried decreased from 41.49 miles in 1909 to 40.38 miles in 1910. Total passenger revenue last year amounted to $10,200,000, an increase of 15 per cent. over 1909. The average amount received per passenger per mile was 2.2 cents.

The total number of tons of freight carried amounted to 20,200,000, an increase of 14 per cent over the previous year; the average haul of revenue freight being 232 miles, just about the same as the year before; and the average revenue per ton per mile was a little over eight mills last year. This is a long average haul and a high ton-mile rate.

The prospects of the Missouri Pacific under a new regime and backed by a strong association of bankers was commented on in these columns last week.

The following table shows the results of operation for the system in 1910, with a comparison for 1909:

	1910.	1,909.
Average mileage operated	6,775	6,489
Freight revenue	$38,201,784	$33,280,482
Passenger revenue	10,210,358	8,893,885
Total operating revenue	53,019,137	46,385,543
Maintenance of way and structures	8,000,104	6,999,729
Maintenance of equipment	7,687,429	7,042,448
Traffic	1,368,745	1,157,524
Transportation	18,889,986	17,237,366
Total operating expenses	37,547,372	33,926,513
Taxes	1,903,004	1,715,758
Net operating income	13,568,761	10,743,272
Gross corporate income	15,462,491	12,437,315
Net corporate income	2,759,411	1,064,509

THE OPINION IN THE EASTERN RATE CASE.

*In re-investigation of the advances in rates by carriers in official classification territory. Opinion by Commissioner Prouty.**

The burden of proof to justify the proposed increase in rates is placed by law on the railways. The advances are justified on the ground that the cost of operation has so increased that although gross operating income has continued to grow, the net operating income has become, and is, insufficient. The question presented to the commission is: are these defendants justified in laying this additional transportation burden on the public for the purpose of obtaining greater net revenue? It might not follow, even though the commission were of the opinion that these carriers were entitled to additional revenue, that they ought to obtain it from an advance in these particular rates. As this case is presented as a preliminary to the consideration of this further question, the commission must dispose of the basic question as above. The commission must stand for the entire public, including the railways; it cannot accede to the mere wish of any class. Next to agriculture, railways are the greatest single industry. Railway extension would mean the employment of additional labor and the purchase of additional material and equipment; and besides asking for increased rates on the ground of the necessity for greater revenue, it is urged by some interests that to grant increased rates would stimulate business, and would put into circulation additional money.

So far as such expenditures are legitimate, they ought to be encouraged. Railways should be kept in a high state of efficiency, and railway charges should be sufficient to permit this, but to the extent that an artificial impulse might be given to railway building and kindred industry, the effect would be in the end baneful, even though the temporary result might seem beneficial.

It must be conceded that railway rates and the treatment of railways should be such as will make the long-time railway bond, which bears a proper relation to the value of the security, a favorite to the investing public. Comparisons which have been introduced between the selling price of railway bonds and municipal bonds would seem to demonstrate that the price of a railway bond is better to-day, as measured by the price of the municipal bond, than it was ten years ago, and this would indicate that in the last decade the credit of the railways has gained and not lost. Never before has the gross amount paid in dividends been as large as in the year 1910, and yet the press, through railway influence, has been filled with forebodings of the disaster. If the railway company is still sound, either at home or abroad, it is not because of, but in spite of, the declarations of railway operators. It would be much better for the government to guarantee bonds than to permit the people and the industries of this country to bear the burden of unreasonable transportation charges.

The railways seek to justify the advances by showing an increased cost of operation, due to increased wages. Figures show that taking the 41 railways involved in this proceeding, the increase in wages for the year 1909 would have amounted to nearly $35,000,000, while the revenue from the proposed advances would only have been $27,000,000.

A comparison has been made between the English act of 1892 and the present United States law. The English act provides that the carrier shall justify the "increase of the rate." Our act provides that the burden of proof shall be on the carrier to show that the "increased rate" is just and reasonable. The English act presumes that the rates in effect December 31, 1892, were reasonable, and the justice of an increase must be tried by that standard. Our act does not intend to say that rates in effect January 1, 1910, are just; on the contrary, any shipper or the commission may attack such a rate. The law was passed at a

*The opinion has been much condensed, but as far as possible the language of the commission has been preserved.

time when the air was filled with rumors of advances in freight rates. The question before the commission is still the same as before the new law, and it is on the reasonableness of the rate in effect, or of the rate to be put in effect.

It appears that during the year ended June 30, 1910, the net earnings of these 41 railways aggregated $51,000,000 more than during the year 1909. The question then, is, to what net earnings are these carriers properly entitled? And the commission follows the United States Supreme Court, in *Smyth v. Ames,* and holds that a reasonable rate is one that affords a fair return on the value of the property. There are two methods of determining value: the cost of reproduction, and the money actually invested in the property. The commission believes that the market value of securities issued against railway property should be taken in consideration in determining a reasonable return. The commission is not fixing the value of a collection of ties and rock and steel rails, but of a railway equipped for doing business. What is that railway worth as a railway for the transaction of a railway business? The market value of railway securities depends largely on the rate which has been charged; and to assume that the market value is a fair index of value for rate-making purposes, is to assume that the rates charged have been in the main reasonable, and these rates were originally in most instances fixed by competition. The commission cannot, of course, allow such rates as will in all cases guarantee prices at which railway stocks have been bought, but in view of the entire situation, it should have that price in mind. The last item mentioned by the Supreme Court in the question of the determination of a reasonable rate is the probable earning capacity of the property under particular rates prescribed by statute, and the sum required to meet operating expenses, which means information necessary to determine the net revenues which will accrue from the application of particular rates. This information the commission has. Outside of the United States a majority of railway mileage is to-day owned and operated by the government; but in this country a vast amount of private capital has been induced to invest in railway construction and operation. It is therefore not only a matter of justice, but in the truest public interest that an adequate return should be allowed on railway capital.

At the same time the railway rate is in final analysis a tax on nearly every species of property, and also on every sort of activity, and there is no reason why all other kinds of property should be required to pay to this particular species of property an undue compensation. The element of risk is less in railway investments than in most industrial operations. There is little fear of competition. What business can be more attractive to the investor than this in which no rival is to be apprehended; where the amount of business is assured, and where the price for the transaction of that business is protected by the fundamental law of the land? At the present market value, the 4 per cent. preferred stock of the Baltimore & Ohio yields a return of 4½ per cent. It seems probable that any railway stock which was certain to pay a dividend of 5 per cent. year after year would sell readily at par.

The railways contend that besides maintaining their property and paying dividends, they should also earn sufficient to make improvements and additions to those properties of a permanent character. In the Yellow Pine Lumber case, in which the commission was sustained by the Supreme Court, the commission held that in fixing a fair return on railway property for the purpose of determining whether a given advance is reasonable, the railway ought not to treat as part of its operating expenses the cost of permanent improvements. It is contended that railways cannot raise the necessary funds to make improvements, and should therefore be allowed to impose rates that will provide these funds. This argument does not appeal to the commission.

By way of illustration, take the elevation of track. On the whole it is an expenditure which adds nothing to the net income of the railway, but just how is that a reason why this improvement should be paid for out of the present earnings? In other words, where lies the difference between a revenue producing and a non-revenue producing improvement? So long as the improvement is for the future, the present must not be entirely taxed to provide it.

On the other hand, it is a wise thing for a nation, as well as an individual, to lay up something for the future; but if we lay up a fund for future generations to offset the tendency to increase prices, is there any assurance that the fund when provided could be made available? The carriers in the proceeding now before us claim they should be allowed to invest in improvements an amount equal to that paid in dividends. In the year 1910 railway dividends aggregated $405,131,650. If this sum were to be invested in our railways annually for the next half century, it would amount at the expiration of that period to $20,256,582,500, not regarding the item of interest. This sum is far in excess of the present total capitalization of our railways. Until the status of the railway surplus is determined by judicial interpretation, the commission cannot properly permit the advance in rates for the purpose of an accumulation of surplus.

It is also said that railways should be allowed to accumulate a surplus for the purpose of providing for the time being for interest charged on new capital which represents an improvement which is necessary and will finally be profitable, but does not pay an immediate return. To this claim within certain limits the commission assents, but to this surplus fund stockholders should be required to contribute by reasonable reduction in dividends. As to the item of obsolescence, under the present system of accounting railways are required to make a depreciation charge on equipment, but they make no such charge for way and structures, and it seems proper that the accumulation of a surplus should be allowed in this view.

Some of the 41 roads might show an actual need for higher freight rates, while others, like the Delaware, Lackawanna & Western, might show no such need. The commission, therefore, had the question forced on it as to what line should be examined for the purpose of determining whether net revenues may properly be increased, and the commission decided, as in the Spokane case, that it must have regard not altogether to any one particular railway, but to the whole situation. On the whole, it seems fair to include with the Pennsylvania the New York Central Lines on the north, and the Baltimore & Ohio on the south, and to take this group of roads as typical of all the rest.

The railways insist that the unit cost of operation has increased. Including taxes as a part of this expense of operation, operating expenses have increased by a much larger percentage than operating income, in the case of nearly all of these defendants. On the Baltimore & Ohio, the Pennsylvania, and the New York Central & Hudson River, the commission finds that in every case the percentage of operating expenses to operating revenues was greater in 1910 than in 1904, and greater than the average for the seven years. On the other hand, the Pennsylvania Railroad shows the cost per ton mile of handling freight traffic, and according to its reports the cost to the company for the calendar year ended December 31, 1909, was lower than for any other year in its whole history, with the exception of 1901. The inference from the figures given by the Pennsylvania is that, since 1894, the unit cost of handling freight has remained about stationary. In the future there is likely to be some advance in the price of coal, but the general cost to the railway of its supplies will not be greater in the immediate future than it has been in the immediate past, and it is fair to assume that wages will not immediately make a further increase. The demands of the public for better service, etc., will continue to add both to the expense of operation and to the cost of plant. It is also probable that taxes will continue to increase more rapidly than the increase in the value of the property.

The railways say that this increase in expense can no longer be offset by the introduction of further economies. Grades have

been reduced and curves eliminated, so that little remains to be done on first-class railway systems. The shippers claim that by the introduction of what was termed "scientific management," the purpose of which was in various ways to make labor more efficient, at the same time increasing the wage paid the laborer himself, much more than the amount of these advances could be saved. The witness who apparently had most to do with originating and applying these methods, testified that they were in actual operation in not over one-tenth of 1 per cent. of all the manufacturing establishments of this country. The system is everywhere in an experimental stage. Representatives of labor have said that these methods could not and should not be introduced in railway work, and the commission can hardly find that these methods could be introduced to any considerable extent, and that therefore the defendants cannot make good any part of the actual advance in wages by the introduction of scientific management.

The railway is a monopoly. It is also well understood that the same men who are potential in the United States Steel Corporation and the American Locomotive Works are influential in directing the policy of the railways. Now, if the steel trust is to determine the price that should be paid for rails and bridges and if the locomotive trust is to determine the price of engines, the car trust of cars and the labor trust of labor, and if the railways have only to meet the demands made by these combinations and charge over to the public, by an increase of rates, whatever is paid, a most unfortunate situation is developed. Business, both freight and passenger, will continue to increase, but not probably at the same ratio as for the past fifteen years. The increase in traffic may, under certain circumstances, be a disadvantage instead of an advantage. For instance, when it requires double tracking the increase may not be sufficient to pay the interest on the money invested in the second track but may be great enough to forbid economical operation on a single track.

Statements filed by the Baltimore & Ohio, the Pennsylvania and the New York Central, show that on these lines the freight tonnage and the freight revenue of 1907 have never since been equaled, yet the Pennsylvania spent between June 30, 1907, and June 30, 1910, $68,000,000, the New York Central $38,000,000 for additions, and the Baltimore & Ohio $16,000,000 for betterment. As a general proposition, it may not be at all certain but that increase of business in densely populated sections may, even in the long run, be a damage rather than an advantage, mainly by reason of the enormous terminal expenses. There have, however, been forces at work in the past few years which have tended to increase the revenue of the railways, as, for instance, the fact that rebates are no longer given. While the gross amount of the increase resulting from all sources cannot be definitely known, it is indicated in official classification territory, by the advance in the rate per ton mile, that the average per ton mile rate of the Pennsylvania in 1900 was 5.04 mills; in 1910, 5.80 mills; of the Baltimore & Ohio, in 1900, 4.56 mills; in 1910, 5.77 mills; of the New York Central, in 1900, 5.58 mills; in 1910, 6.25 mills.

Answering the question "Should the published tariff be advanced with respect to the three systems selected as typical?" the commission should inquire: What were the net revenues for the year 1910? What would those revenues have been had the present wage scale been applied to the operations of that year?

Would the revenue resulting from the application of the present wage scale to the operation in 1910 have been sufficient for that year?

Will the revenue which would have resulted in 1910 from the application of the higher wage scale be likely to increase or decrease in the future, and, if sufficient in 1910, will it continue to be adequate?

BALTIMORE & OHIO.

From 1901 to 1910, the total operating revenue of the Baltimore & Ohio increased 91.4 per cent.; total operating income 60.2 per cent.; income per single track mile, 16.2 per cent.; income per all-track mile, 5.1 per cent. If the company is to preserve its financial integrity on the basis of its present capitalization and maintain its credit, it is true that it must be allowed to earn a sufficient amount to pay its interest, its preferred 4 per cent. dividends, a dividend on its common stock and have remaining a substantial surplus. The commission is of the opinion that the sum remaining after the payment of fixed charges, including as a fixed charge the dividend on the preferred stock, should be equivalent to between 7 and 8 per cent. on the common stock. The company should have sufficient earnings to pay a dividend of 5 per cent. on its common stock, and carry 2½ per cent. surplus, or pay 6 per cent. and carry 1½ per cent. surplus. This is on the assumption that the capitalization does not exceed its actual value.

Had the increased wage scale been in effect during the entire fiscal year ended June 30, 1910, the Baltimore & Ohio might have paid on its common stock a dividend of 6 per cent., carrying forward a surplus of $2,776,000. Or it might have declared a dividend of 5 per cent. and had a surplus of $4,296,000. In the commission's judgment these net earnings would be extremely liberal to the Baltimore & Ohio, considering its present capital stock and its past history. The commission does not believe that 1910 was an abnormal year, and does not accept the showing made by the road in the seven months since the close of that fiscal year as conclusive. Allowing for interest on the new $40,000,000 notes, the Baltimore & Ohio might have paid a dividend of 5 per cent. on its common stock, and had $2,500,000 surplus. Moreover, the Baltimore & Ohio has a surplus of $22,000,000 accumulated in the last 11 years. It is to tide over just such periods as that intervening between the time when the interest on the $40,000,000 notes begins to be paid and the time when that $40,000,000 begins itself to earn money through economies of operation, etc., that the commission has approved of the accumulation of a surplus.

Should the cost of operation continue to increase, this company may find it necessary in the future to make a general advance in its rates in order to maintain its credit on the basis of its present capitalization, but this record does not contain any satisfactory evidence that this is now necessary.

PENNSYLVANIA RAILROAD.

The operating revenues of the Pennsylvania Railroad were $95,000,000 in 1901, and $166,000,000 in 1910, an increase of 74.4 per cent., while the net revenue during the same period increased from $33,000,000 to $44,000,000, only about 33 per cent.

The operating income of the Pennsylvania Railroad for 1910 was $44,000,000; its rents and interest $21,000,000, leaving available for dividends and surplus $23,000,000. Dividends amounted to nearly $22,000,000, and a 6 per cent. dividend on the total amount of stock outstanding June 30, 1910, would be almost $25,000,000. The Pennsylvania is a great stock-holding corporation, and income on the securities owned amounted in 1910 to substantially $17,000,000; so it appears that during 1910 approximately $18,000,000 remained after the payment of taxes, rent, interest and dividends; so that if the wage scale had been in effect and expenses been $7,000,000 higher, the company would still have had a surplus of $11,000,000. The commission again does not take the showing made in the past seven months as conclusive evidence. While it may be true that in the future, as in the past, the ratio of operating expenses to gross income will somewhat increase, there is nothing to account for such increase in these seven months, and the commission would not be justified in assuming that this increase will continue until actual circumstances has demonstrated the fact. In view of the munificent earnings of this company in the past, there is not any hardship in asking that these rate increases be deferred until their necessity has been shown.

PENNSYLVANIA COMPANY.

Whether the commission examines the Fort Wayne route either from a standpoint of the owners of the Pittsburg, Ft. Wayne & Chicago, or from the standpoint of the Pennsylvania Company, which now leases and operates it, there is certainly

no suggestion of any necessity of increased revenue, by reason of advanced wages.

PITTSBURG, CINCINNATI, CHICAGO & ST. LOUIS.

After the payment of rents, interest, etc., there was $5,854,000 available for dividends on the Pittsburg, Cincinnati, Chicago & St. Louis, and the company paid 5 per cent. on its common stock, and 5 per cent. on its preferred stock, leaving a surplus of $2,873,000. Considering the high capitalization per mile of this road, it is impossible for the commission not to feel that its earnings for 1910, even when reduced by the full amount of the wage advance, will be extremely liberal for that property.

NEW YORK CENTRAL & HUDSON RIVER.

The operating revenue of the New York Central & Hudson River increased from $54,000,000 in 1901, to $101,000,000 in 1910, an increase of 85.2 per cent.; while operating income increased from $17,000,000 in 1901 to $23,000,000 in 1910, or 33.3 per cent. These figures have less significance, since during the decade the system has increased by the taking-on of several important properties. The commission finds that if the wage increase had been in effect in 1910 and the new interest requirements had also been in effect, the New York Central could not have maintained its present rate of dividends without obtaining more money from some source. As to the arguments made by the railway that its income from other sources was unusually large last year because of the 6 per cent. extra dividend on the Lake Shore stock owned, the commission finds that the Lake Shore is probably amply able to pay every year 18 per cent., which includes this extra 6 per cent. The New York Central & Hudson River came into existence in 1869 by the consolidation of the New York Central Railroad and the Hudson River Railroad, and the evidence shows that the capital stock now contains $57,000,000 par value, for which nothing was ever paid, and there has been paid out on this $57,000,000 stock at least $120,000,000 in dividends. In looking at the financial condition of these companies for the purpose of determining what a reasonable rate should be, the commission cannot entirely close its eyes to bits of history like that.

LAKE SHORE & MICHIGAN SOUTHERN.

Had the increased wage scale been in effect during the year 1910, it would have added to the operating expenses of this company $1,500,000, and would have diminished its net by that amount. During the year 1910, therefore, the Lake Shore could have paid the higher wages and declared its dividend of 18 per cent. and had remaining $5,000,000. It might during that year have easily paid a further dividend of 6 per cent.

MICHIGAN CENTRAL.

The Michigan Central does not present as strong a case as the Lake Shore, but it would have no difficulty in paying the advanced wages and showing a substantial surplus after declaring a dividend of 6 per cent. The three railways together, the New York Central, the Lake Shore and the Michigan Central have certainly made a much stronger showing for an increase in rates than the other two systems previously examined. It should, however, be noted that the present necessities of this system arise mainly from the fact that it is forced to make changes at this time and large outlays, which, while profitable finally, will not yield an immediate return on a considerable part of the amount invested.

The commission, on the whole, finds that the advances have not been justified, but since there may be some cases where the commodity rates may need to be adjusted, the commission dislikes to tie up by hard and fast order, these commodity rates, and has concluded as to all the rates involved in this proceeding, to simply require the defendants to cancel on or before March 10, their advance tariffs on file and restore their former rates, which are the rates now in effect. If this requirement is not complied with, the proposed rates will be suspended, the necessary findings of fact made, and the usual two-year order issued as to all the tariffs involved.

OPINION IN THE WESTERN RATE CASE.

In re investigation of advances in rates by carriers in Western trunk line trans-Missouri and Illinois Freight Committee territories. Opinion by Commissioner Lane.

More than 200 railways operating in Wisconsin, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas and Montana are parties to these rates. The present American law, placing the burden of proof on the railways to justify increased rates as reasonable, should be distinguished from the English law. The English commission has to deal with the increase itself in the rate, and not with the increased rate. This distinction is fundamental in the consideration of the laws of the two governments. The American law places the question of reasonableness not on the increase but on the rate. The purpose of Congress was to give the commission the same plenary power over increased rates that since the enactment of the Hepburn act it has enjoyed over other rates. The assumption of the law is that the railway which increases its rate takes such action knowing that the law casts on it the "risk of non-persuasion." The carriers in the present proceeding have assumed this burden. The common ground for these common advances may be epitomized in the language of the leading witness for the carriers, "we need the money."

Later it became manifest that the purpose of the carriers was not so much to secure approval of their specific rates as to discover the mind of the commission with respect to the policy which the carriers might in future pursue, and to secure, if possible, some commitment on our part as to a nation wide policy which would give the carriers a loose rein. The carriers charged with the public trust were given a free hand in the institution of their own rates until within the last four years, and they now appear asking the protection of a law to increase their rates, which, under the play of economic forces, they say never have been higher. President Ripley, of the Santa Fe, being asked if, in his opinion, the result of operating revenues without regulation had resulted in not making a proper return to the carriers, answered emphatically "I do." "And now that we have regulation, rates should be put on a paying basis." "Is that your opinion?" he was asked, to which his answer was "Yes." Could there be any position less reasonable than to cry out against restrictive legislation and in the same breath ask benefits under this legislation which never were, and admittedly never could have been, in the open field of unlimited competition?

While there doubtless has been spasmodic and demagogic effort in various sections of our country which made for the injury of carriers, the trend of control of regulation, as a whole, has been conservative, wise and sympathetic towards the investors in such enterprise.

On July 1, 1901, there were in the United States reporting to the commission, 195,561 miles of railway, yielding a gross operating revenue of $1,572,960,868, or $8,043 per mile. The net operating revenue amounted to $577,221,171, or $2,951 per mile. On July 1, 1910, there were 238,411 miles of line, with $2,818,411,419 gross income, or $11,822 per mile. The net operating revenue reached the unparalleled figure of $932,848,978, or 3,913 per operated mile, an increase of 50 per cent. in net per mile over the figures of ten years ago.

Coming to a consideration of the return to holders of American railway stocks, we find a result equally gratifying. It is almost axiomatic that the investment in an American railway is not represented by its capitalization. This generalization is subject to a few exceptions. In 1888, 38.56 of stock was paying dividends, and the average rate on the dividend paying stock was 5.23 per cent. In 1910, 67.20 per cent. of the stock was paying dividends, and the average rate on dividend paying stocks was 7.47 per cent. Thus we see that at the very time that the carriers in the East and in the West were taking united action to increase their rates, they were compiling their annual statements, which show from the standpoint of net revenue and of

dividends on stock that the railways of the United States, as a whole, have never before prospered, not even in the heydey of 1907, as they did in 1910, which, be it remarked, was but two years removed from the financial panic of 1907-8.

As to ability to raise money abroad, the American railway man is placed in an awkward dilemma. European shareholders insist on larger dividends because of increasing profits, while he is demanding higher rates in order that his credit at home and abroad may be sustained.

In the Western hearings the burden of supporting the increase in rates has been assumed largely by the Santa Fe and the Burlington; but the commission has also studied the figures of the Chicago & North Western, the Chicago, Milwaukee & St. Paul, the Chicago, Rock Island & Pacific, and the Chicago & Alton. On a capitalization of $84,000 per mile the Santa Fe earns approximately 4 per cent. on $44,000 bonded debt, 5 per cent. on $20,000 preferred stock and 9 per cent. on $20,000 common stock. From a glance at the income statement of the Burlington it will be seen that its net profit in 1910, after deducting all operating expenses, taxes and fixed charges, amounted to nearly $14,000,000, which allowed an 8 per cent. dividend on its stock and a balance or surplus of $5,108,000, or the equivalent of 12 per cent. on the common stock. The railways of the United States in ten years have floated mortgage bonds on their property to the extent of upward of $4,025,000,000. Their mortgage indebtedness increased 77 per cent., while their mileage increased but 36 per cent.; and on this mortgage debt interest was paid in 1899 at the rate of 4.55 per cent., while in 1909 it was paid at the rate of 3.90 per cent.

So far as the bond buyer is concerned, no matter to what elevation rates might be raised, it would not increase by a fraction of a cent the interest which he would receive. The one interest, therefore, that a bondholder has, or the bond buyer has, is in the stability of his security. The stockholder, on the other hand, has an interest in railway revenue, because his interest in the property is necessarily speculative. Railway financiers themselves, who but a short time ago were so reckless in the issuance of stock, which, as they admitted, had no immediate value, but was a capitalization of the future, are taking a position that is more responsive to the best public sentiment.

We next come to the consideration of surplus. The carriers, even under the rules of the commission obtaining only during the last two or three years, are given in the widest latitude as to charges that shall be made against the maintenance accounts. The carriers of the United States have accumulated unappropriated surplus amounting to $800,642,923, whereas in 1899 their surplus as given in the books of the carriers was but $194,106,367. In ten years, with an increased rate of dividend, an increased maintenance charge and a vastly increased fixed charge for interest, these carriers have accumulated a surplus of $606,536,556, an increase of 312 per cent. on 1899, while the mileage has increased 36 per cent. In the last analysis a surplus is a matter of bookkeeping. Rates might be doubled in this territory and leave the surpluses of the carriers where they are to-day. It may well be that with a larger surplus, bonds or stocks might have sold at a higher figure, but this is problematical; and, furthermore, it may be asked, is it wise or necessary to accumulate a surplus much more rapidly than at the rate of 100 per cent. in ten years?

There is much persuasiveness in the argument that surplus should be treated as a public fund, out of which the carrier may create facilities which will produce more efficient and satisfactory service without adding to the liability. A premium must be put on efficiency in the operation of the American railway. Rates cannot be increased with each new demand of labor, nor should rates be reduced with each succeeding improvement in method. The standard of rates must be so high that the needed carrier which serves its public with honesty and reasonable effort may live. And yet rates should be still so much below the *possible* maximum as to give high and exceptional reward to the especially capable management, the well co-ordinated force and plant.

This is the ideal unrealized, perhaps, but it points the way. However, since the commission cannot declare that accumulated surplus shall not be capitalized, the adoption of a plan to treat it as a public fund rests entirely with the carriers. A railway is justified no doubt in maintaining a surplus which will insure dividends to its stockholders during the years, and it may accumulate through years funds to meet obsolescence in plant unless this charge is taken care of in maintenance. The one other legitimate end for which the surplus may, in reason, be accumulated is to supply facilities in the nature of luxuries, which cannot be made to yield adequate return on the capital invested.

The Burlington claimed that it had a legal right to increase its charges because it is not now receiving a fair return on the value of the property which it uses, value being estimated as cost of reproduction. What did the Burlington cost to build? What is its present value? Whence came this value? Is such increase in value a basis for increase in rates? The total investment in the property from the sale of securities was $2,580,000. The company claims its present value is $530,000,000. The difference, $270,000,000, represents investment made out of earnings, an increased value of right of way and terminals. It remains for the supreme court yet to decide that a public agency, such as a railway created by public authority, may continuously increase its rates in proportion to the increase in its value either because of betterment made out of income or because of the growth of the property in value. The commission's position is that a railway may not increase rates on shippers for this reason, and as an outgrowth of the fact that it has accumulated out of rates a balance of profit which has been invested in the property.

In considering what is a reasonable rate, President Ripley testified that a reasonable rate was "what the traffic would bear and still move most freely and enable the products and manufactures of one part of the country to be used to the utmost extent in the other." While this definition sounds most philanthropic, it was doubtless not intended to convey any more subtle or philosophic meaning than this: that an individual rate should not be made with reference to the cost of the service to the railway, nor should it be made with regard to the return which it would yield to the capital invested in the plant. It should be made so low that as great a body as possible of that character of traffic should move, but all the time there must be borne in mind the fact that out of its aggregate rates the property must be made to pay. "What traffic would bear" carried to its last degree permits indefinite discrimination between individuals as well as between communities. The traffic manager of one of the leading roads was asked to assume that one man owned all of the roads in that territory and to give any reason why rates should not be raised to the class basis, or 200 per cent. The traffic manager answered, "Because the advance would be too great of itself." "It would be a shock to my sense of propriety and to my sense of justice," and that was the ultimate word. Rates are no higher than they are, not because there is any maximum standard based on the cost of service or the return to the carrier, but because to increase them would not "be fair, or decent, or proper"; in short, would not appeal to the conscience of the traffic manager; and this same witness was unwilling to acknowledge that his judgment of what was proper, reasonable or just should be subject to review by this commission or any tribunal, a position which may fairly be characterized as a modern extension of the ancient principle of divine right. Possibly it is not too much to hope that in some good day some traffic manager will announce the principle that a railway function is to sell transportation at a fair rate, and that it is beside his place to be the ultimate regulator of economic conditions of the country. To be sure, we can never depart from the ad valorem principle in making rates; no government railway system does.

While the commission finds the carriers contending uniformly that in making a reasonable rate the cost of service is practically a negligible factor, yet the contention is herein made that the carriers should be allowed to increase their rates on that ground; in short, that addition to cost of service justified increased rates.

An analysis of operating costs shows that an approximation of the unit cost of performing transportation service may be obtained. Once the commission has learned the comparative cost for various services, it is not fanciful to say that a schedule of rates may be made which will approach justice as between services.

As to increased costs—there is no general conclusion to be drawn from the figures which have been prepared as to the price of coal; but it is probably fair to say that, as to the average road, $1 worth of fuel in the last five years in the decade would carry a ton of freight as far as it would in the first five years in the decade.

While the standard white oak tie costs five or ten cents more, the general increase in this expenditure is almost unnegligible. It will increase the cost of maintenance less than $50 per mile per year.

[The wage increases of 1910 were in effect during the six months from July 1 to December 31 of last year. This period, therefore, is compared with the previous six months, and with the corresponding six months of 1909 and 1908, and the following figures are abstracts from a number of tables comparing each road considered with itself on a per mile basis.]

The Chicago, Burlington & Quincy's operating income per mile of road in the last six months of 1910 was $1,718, as compared with $1,039 in the first half of 1910, and $1,368 in the last half of 1909. (Operating income is the net return after the payment of expenses, taxes and any deficit from outside operations.)

The Chicago, Rock Island & Pacific's operating income per mile of road in the last half of 1910 was $1,221, as compared with $661 for the first half of 1910, and $1,204 for the last half of 1909.

The Chicago, Milwaukee & St. Paul's operating income per mile of road in the last half of 1910 was $1,176, as compared with $1,031 for the first half of 1910, and $1,330 for the last half of 1909.

The Chicago & North Western's operating income per mile of road in the last half of 1910 was $1,415, as compared with $1,032 for the first half of 1910, and $1,454 for the last half of 1909.

The Illinois Central's operating income per mile of road in the last half of 1910 was $1,743, as compared with $1,348 for the first half of 1910, and $1,290 for the last half of 1909.

The Atchison, Topeka & Santa Fe's operating income per mile of road in the last half of 1910 was $2,126, as compared with $1,711 for the first half of 1910, and $1,986 for the last half of 1909.

The carriers have passed through the period of immediate experiment under these added costs, and found there is promised a continuance of the prosperity this year which was their's in 1910. These six months' figures establish beyond reasonable doubt, taking the carriers as a whole, that the increase in wages does not come out of net, but out of increased gross. If these increased rates are to be allowed must we not say, with Mr. Ripley, that in the past all rates have been too low, and that by force of our power to protect these carriers against intense competition between each other, we will aid in the raising of rates on to a higher level?

A strong plea is made on behalf of what are known as the poorer roads in this territory. It is almost axiomatic that rates cannot be made so as to give high rates to a poorly placed, indifferently operated or isolated road without making the rates absolutely extortionate.

In concluding, the strength of the carriers' case is in these two contentions: (1) That the roads are not earning a fair return on the value of their property; (2) that the cost of operating has increased because of increased wages. It is true that cost of operation has increased by the amount shown as allotted to labor and addition to wages; but it is also true that operating revenues have increased so as to more than absorb increased operating expenses, as is shown in the six months' statement above. Moreover, the figures furnished would indicate that under skillful management an additional tonnage may be handled under a higher wage schedule without increasing the cost of service given.

We are dealing here with a difficult problem involving multitudinous facts and an infinite variety of modifying conditions, which make the establishment of principles and the framing of policies a matter of slow evolution. Congress has laid down a few rules. These rules we are attempting to apply. The railways may not look to this tribunal to negative or modify the expressed will of the legislature. They have laid before us the facts and law, which would make for a justification of their cost in the increasing of rates. To our minds, their justification has not been convincing.

We do not say that the carriers may not increase their income. We trust they may, and confidently believe they will if the time does come when through changed conditions it may be shown that their fears are realized, or approaching realization; and from a survey of the whole field of operations, there is evidence of a movement which makes against the security and lasting value of legitimate investment, this commission will not hesitate to give its sanction to increases which will be reasonable.

HAVANA PASSENGER STATION.

The new passenger terminal in Havana, Cuba, which is in the course of erection for the Havana Terminal Railroad Company, will be one of the finest and most up-to-date structures in Cuba. It is situated on what is known as the Arsenal site near the harbor, and will be built in connection with wharves, warehouses, and all the other necessary terminal improvements.

The building will be used by the United Railways of Havana, the Havana Central, and the Marianao Railroad, thus serving as the union passenger terminal for the city of Havana. As tourists' traveling is becoming more important every year, the station has been designed to take care of this need, and has a capacity which will suffice to satisfy all requirements for many years to come.

The station building itself is 240 ft. x 70 ft., and will be a three-story and attic structure. The main waiting room is 72 ft. x 128 ft., and extends all the way up to the roof, having a clear height of some 60 ft. It will be finished in Italian marble with Mosaic floor, and will have adjoining it the usual men and women's retiring rooms, toilets, etc. These toilets will be divided up into two classes; that is, the first-class toilet will have the nickel-in-the-slot idea, whereas the second-class toilet is the ordinary free arrangement.

The cafe is 40 ft. x 52 ft., and is on the most attractive corner of the building. This cafe will have a high wainscot of elaborate Spanish tiles, and a marble bar. The cafe is entirely open with the street on two sides with a sufficient sidewalk to allow placing cafe tables there, as is done in European cafes. A large baggage room, with the usual mail and parcel rooms, occupies the other end of the building. In addition to the large waiting room, there is a concourse 50 ft. x 200 ft., provided with seats to take care of a large part of the traffic.

On the second and third floors will be the offices of the United Railways of Havana. These offices will surround the main waiting room. These floors are served by two electric elevators in one of the towers of the building, and a freight elevator in the rear.

The exterior of the building is in the style of Spanish Renaissance, and will be built of American terra cotta. A great deal of color will be introduced throughout the building to conform to the tropical climate and the wealth of color which one finds in Cuba. Distinctive features of the front elevation are the twin towers, arising 130 ft. above grade. These towers will contain water tanks of 20,000 gal. capacity, to be used for fire and storage purposes. The towers will also form an excellent point of observation for visitors to Havana. The roof will be covered

with red Spanish tile, which is used freely on Cuban buildings.

A pecular feature of the building is that there will be no glass in the windows, with the exception of a small panel in the shutters, and also panels in the toilet room windows. Double sets of shutters have been provided for all the windows; the exterior set with fixed louvres, to be closed in the case of an ordinary rain-storm, and an interior set with reinforcing bars and extra heavy bolts to be used when the famous Cuban hurricanes come along. The light penetrates so far into the buildings in Cuba, that even with all the shutters closed the rooms seem as bright as in an ordinary American building with everything open. In fact, two of the principal problems in Cuban construction are keeping the light out and keeping the roof on.

Havana Passenger Station; United Railways of Havana.

The construction work of the building, the wharves, the terminal, the yards, and the elevated railway on which all trains will be brought to the station, will be performed by the Snare & Triest Co., constructing engineers, New York City, who have had much experience in this class of work, having built the Hoboken terminal of the Lackawanna, the Staten Island ferry house, and the Whitehall street ferry terminal, in New York City.

The building has been designed by Kenneth M. Murchison, of New York City, who has built the Hoboken terminal and the Scranton station for the D. L. & W., and is now engaged on the Baltimore union station and the Newark station for the Pennsylvania Railroad.

CANADIAN PACIFIC GRAIN ELEVATOR.

The Canadian Pacific recently completed at Victoria Harbor, Ont., on the Georgian bay, an unusually large elevator for unloading the grain boats from the head of Lake Superior. The company had already provided ample elevator capacity at the upper lake ports for transferring to boats the grain shipped down from western Canada, but there was a lack of facilities for storing and transshipping it at the eastern end of the lake haul. The new elevator at Victoria Harbor has been built at a cost of $1,100,000, including the necessary wharf. The wharf is of concrete, 800 ft. long, and is carried down to provide for a depth of water of 25 ft.

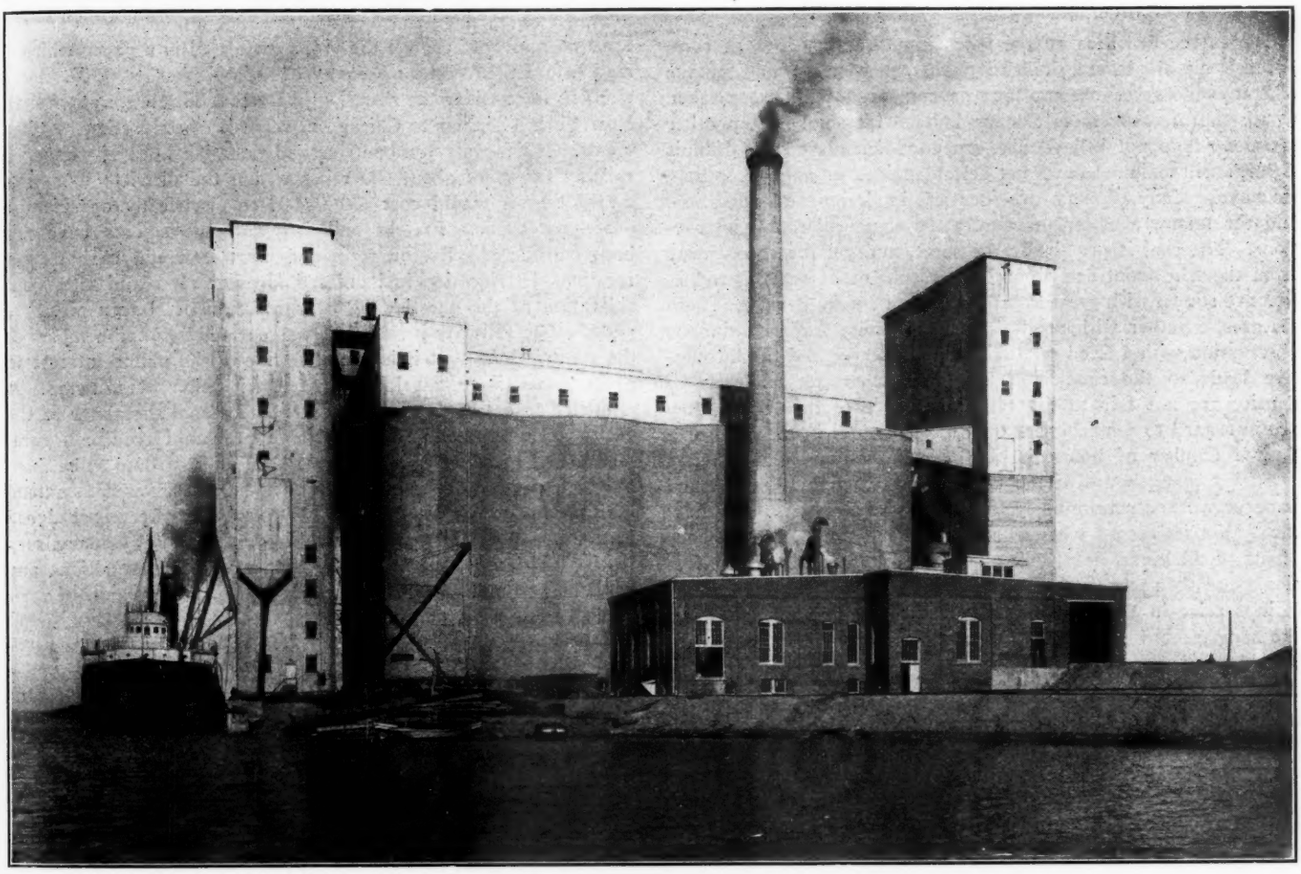
Grain boats are unloaded by two marine towers, 150 ft. high, built of structural steel and covered with corrugated iron. These towers are supported on 40 wheels each, the wheels being arranged in standard frieght trucks, and each is self-propelled independently along the double track which parallels the wharf. This movement is obtained by housing sufficient motor equipment in the base of the tower to operate a large drum winding up a cable which is passed out of the tower, around a fixed block and back to a fixed connection on the tower. This allows both towers to work to full capacity regardless of hatch spacing or hold capacities of incoming boats. The marine legs are specially designed to enter passenger boats as well as freight. The towers have an elevating capacity of 20,000 bushels an hour.

The grain unloaded from boats may be stored or reshipped in cars direct. The storage capacity of the elevator plant is at present 2,000,000 bushels, but arrangements have been made to allow for future extensions that will increase this amount to 10,000,000 bushels. There are 32 storage tanks, cylindrical in shape and 35 ft. inside diameter, built of reinforced concrete, and there are 31 interspace bins, each of which has about one-fourth the capacity of the cylindrical bins. All bins have hoppered bottoms and are thus self-emptying. When cars are to be loaded direct from the boats, grain is handled from the unloading towers, on conveying machinery above the storage bins to the working house shown on the right of the accompanying photograph, into which cars to be loaded can be run direct.

The electric power for the operation of the entire plant is furnished by two 500-k.w. turbo-generators in the power plant, which is in the foreground of the view shown. All conveying

and hoisting apparatus is motor operated. All electric wiring is carried in metal conduits, and the building is fireproof in every respect. Electric lights are provided so that work can be done readily at night, the installation including 750 incandescent lights and 12 arc lamps. Telephones, electric signal light and bell systems, and dust collectors have also been provided.

The construction of the entire plant was under the direction of J. G. Sullivan, assistant chief engineer, and under the supervision of G. G. Ommanney, resident engineer. The plant was designed and built by the John S. Metcalfe Company, Montreal,



Victoria Harbor Elevator; Canadian Pacific.

Que., and most of the conveying and elevating machinery was furnished by the Dodge Manufacturing Company, Toronto, Ont.

LOCOMOTIVE SMOKE IN CHICAGO.

In our issue of February 17, we published a full abstract of a paper on locomotive smoke in Chicago by the city smoke inspector, Paul P. Bird. In the discussion of the paper at the Western Society of Engineers' meeting, C. A. Seley, mechanical engineer of the Rock Island Lines, presented the railway side of the question. Following is an abstract of his remarks:

At a meeting of the Western Railway Club in November, 1909, Mr. Bird made the following statement: "As to the exact proportion of Chicago's smoke that is made by locomotives, it is a very hard thing to even make an estimate of. It is largely a matter of opinion." It would now seem as though Mr. Bird believes that he has reduced the matter to an exact science, and in doing so he finds the railways as the chief offenders in the making of Chicago smoke.

I will not question the distribution of the annual consumption further than to say that each of the items are estimated and could hardly be arrived at otherwise. The item of railway coal is said to be accurately estimated, because made by the railways, but we decline the compliment for the following reasons: It should not be a difficult matter to obtain the amount of coal used in a stationary boiler plant, provided one has access to the accounts, but for locomotives the question is complicated. For instance, the Chicago city limits are from nine to twelve miles from the railway depots. Every through train, most of the suburban trains, and many transfer trains of freight cross the line daily, and the proportion of coal actually burned within the city limits is very difficult to estimate. Some of these engines are housed within the city limits, others bring their trains to the depot, and in a half hour are out of the city again. Others arrive from the outside, take their trains to the yard and go out of service, possibly until the following day. Some switching engines are in continuous service within the city limits, while others are not. Railway accounts are made up for the terminal divisions, which extend beyond the city limits, so that the amount of coal burned within the city limits is entirely a matter of estimate.

Not only is this true of the coal consumed within the city limits, but of the number of engines within the limits at one time, so that there are two variables in the estimate. The influence of these may be shown by analyzing some of the figures on the last page of Mr. Bird's paper. The total number of engines in Chicago at one time divided into the total tons of coal burned daily is about four tons per engine per day. The individual roads quoted run from 1.4 to 28 tons per engine per day.

It is stated that a special observer made over 11,000 observations of the density of locomotive smoke in October and November, 1910. Assuming fifty-two working days in that period and eight hours per day, this would make 26.4 observations per hour. As many hours, and perhaps days, had weather that did not permit accurate comparative observation, the rate must have been higher than this. Observations of a stationary stack can be taken for as many minutes as may be desired and the smoke density classified by the Ringlemann charts. The observer and the stack are in a fixed relation, but with a moving locomotive

the distance attained from the observer in one minute may be as much as one-half mile, and, no doubt, many of the 11,000 observations were long distance records. The point of observation is stated to be frequently at junctions of two or more railways. Everyone knows that such points are always approached with caution and frequently stops are required, and it is impossible under such conditions to as fully control the fires and smoke as at other points. As a matter of fact, the table of location of points of observation shows mainly points where such adverse conditions obtain rather than a fair average over the entire line within the city limits, and explains the high percentage of smoke density to a considerable degree.

The smoke densities on the lake front are very low, as compared with all others, indicating that the background of the lake influences the observations as compared with those taken where the atmosphere is already laden with smoke from other sources. I do not believe that my good friends on the Illinois Central will claim to have any better engines or appliances than we have. Many of them are identical in design and operation, and the men are under practically the same rules and instructions. The coal is practically the same, and yet the roads away from the lake front and among other sources of smoke production are shown with greater percentages of smoke density. These features, together with the lack of opportunity for a continuous observation with a fixed relation of the observer and the locomotive leads to the conclusion that the statements made as to density are not fair to the railways. Even if they were, they are in regard to a machine that in most cases is in the city for a limited number of hours, is out of commission and smokeless often for many hours of the twenty-four when in the city, and is never worked continuously to capacity for any great length of time. Yet its record when at work is compared with stationary plants of all kinds, nearly all of which are in continuous operation. In other words, the smoke density of a locomotive which is in service in the city one-half of the twenty-four hours has the same record as if it was operating continuously, so far as these statistics are concerned.

The statement as to the amount of cinders thrown from stacks of locomotives is overstated. There are only a couple of testing plants in this country where experiments have been made to ascertain the amount of cinders passing out of stacks and even these are not exact. During the St. Louis exposition of 1904 the cinders discharged from the stacks and those caught in the front ends amounted to about 10 per cent. of the total weight of fuel burned. These engines were worked at full capacity at various speeds, whereas the engines in Chicago work at full capacity only a portion of the time, so that 10 per cent. is entirely too high. This is particularly true of switch engines, where actual mileage per day is very low, and this class of engine is predominant in the city. The throwing of cinders is probably greatest on suburban engines, which make numerous stops and have to accelerate rapidly.

Although, as stated, I disagree with the conclusions in Mr. Bird's paper, believing that the railways do not make the proportion or density of smoke credited to them, I do agree to the principle of smoke regulation insofar as it can be economically enforced and with due regard to the public health and comfort. Furthermore, I believe that the railways are generally of that opinion and are endeavoring to co-operate with the city to that end. My use of the word economy is in the broad sense. Pittsburgh could not make steel for the world and be a smokeless city, neither can Chicago be the distributing point and clearing house of industry of the middle west and be a smokeless city. True economy means a wise use of our natural resources and a checking of waste. The steam locomotive, as Mr. Bird truly says, is a highly developed machine and, contrary to what many people think, is a highly economical machine. The locomotives in this country, except a few in the anthracite territory, or where oil is available and cheaper than coal, use soft coal and make more or less smoke. Pocahontas coal is cited as making less smoke than others, which is true, but would the business interests of our vicinity regard the use of Pocahontas coal on locomotives as of economic advantage to the community at large? The expenditures of Chicago railways for fuel should go to build up the business interests of Illinois and Indiana, rather than of Virginia. Considerations of economy in this sense, therefore, lead us to use local fuels, but in connection with approved appliances and constant vigilance to keep the smoke to a minimum.

Allusion is made in the paper to electrification as the panacea, "the only final and satisfactory solution of the smoke problem." This is a large question and a debatable one, and I can only touch on a very few points. Although fifteen months have passed, I see no reason to change the views expressed in a paper which I read before the Western Railway Club in November, 1909. I invite you to consider the situation in Boston. That city rather than New York is similar to Chicago as regards electrification requirements. It has water on one side and radiating lines of passenger railway tracks of about 600 miles within the district; it is estimated that it would cost $39,000,000 to electrically operate the passenger traffic. Freight and switching movements have not been considered. Boston recognizes that it would have to pay for that electrification in increased fares or rates and after consideration of the question by a commission of sixteen members and the two railways involved, it was decided by nine members of the commission* that it is not wise nor in the public interest to exact legislation compelling any electrification of railways. A minority report of five members dissented from the above to the extent of recommending legislation that would require a commencement of actual work of electrification at a date to be fixed by the general court or some public agency designated to extend the time for good cause shown. A second minority report signed by two members dissented from the above idea of any compulsory legislation, but would require continuance of investigations and studies as to plans and estimates, taking up the question of rates as well as costs.

According to Mr. Bird's figures, Chicago has about 670 miles of main lines, which compares closely with that of Boston and has in addition over 1,500 miles of sidings, all of which have to be considered for complete electrification. Can Chicago pay the price, as it will undoubtedly have to do if electrification is to be an accomplished fact on her railways? If the public can afford to pay the price for electrification a certain degree of smoke and dirt reduction may be accomplished, but it is doubtful if the general atmosphere of Chicago would be greatly cleared. The enormous quantity of soft coal otherwise used is too great a factor. As regards the matter of health, an examination of the death rate of various American cities does not put one in fear of a Chicago residence as being extra hazardous.

*A summary of the conclusions reached by the Massachusetts Joint Board on Metropolitan Improvements is as follows: Electrification is desirable because of comfort and convenience of the public and some advantages to the railways. Best methods are still undetermined. Electrification of terminals under the present conditions does not result in economy but increases expense, aside from the interest incurred. If greatly increased traffic would result from electrification, the expense per unit would be reduced. Electrification would oblige railways to make charges to operating expenses, due to property abandoned or replaced, in addition to interest on new capital and increased expense of operation. Electrification would require an increase of passenger fares to produce the revenue to pay for it. Electrification, while desirable, is not necessary nor required on the grounds of public safety. To compel electrification would postpone other expenditures demanded by considerations of increasing traffic, etc. Railways are already hampered in obtaining capital by other regulations of the state and government. As a result of the foregoing conclusions, the Board believe that it is not wise nor in the public interest to enact legislation compelling any electrification of railways.

Boston passenger and suburban service is nearly three times that at the Grand Central station, New York, and the number of lines, as compared with New York, makes the expense in Boston much greater than in New York. (This is a consideration which would also rule in Chicago.) It is believed that rates should be raised for both passenger and freight traffic to provide necessary capital if both classes of traffic are required to be moved electrically. Such increase in rates should be borne by Boston business interests. The benefit of electrification in Boston will accrue mainly to commuters and short distance traffic, and owners of property along the lines electrified. An increase of suburban fares will discourage the development of suburban territory and divert travel. For reasons connected with evolution of electric traction, also the demands for increasing traffic in other directions, it is believed that these matters should be allowed to work out themselves without legislative enactment. The report calls attention to the partnership of the public in all such improvements without risk, and its attitude should be to encourage a legitimate and economical expenditure of capital with fair compensation.

Shop Section.

THE first prize of $35 in the car department competition, which closed February 15, has been awarded to Robert G. Bennett, motive power inspector of the Pennsylvania Railroad at the South Pittsburgh shops, Pittsburgh, Pa. The second prize of $20 was awarded to A. G. Pancost, draftsman, Elkhart, Ind. Both of these articles appear elsewhere in this issue. The freight car material storehouse described in Mr. Bennett's article is inexpensive and provides a simple, easy and efficient means of caring for this class of material.

ENGINE house kinks is the subject of the competition which closes March 15. The engine house is a critical point in the operation of a division and the rapid and accurate handling of locomotive cleaning and repairs is of utmost importance. Labor and time saving kinks are absolutely necessary. Most of them are simple both in construction and operation. Send in sketches, photographs or drawings of the best two in your engine house, together with a clear and thorough description of them. A first prize of $35 will be awarded for the best collection of two kinks, and a second prize of $20 for the second best collection. Others that are accepted for publication will be paid for at our regular space rates. More than two kinks may be submitted, if desired, allowing the judges to base their decision on what they consider to be the best two in each collection.

NOW is the time to start work on your contribution to the competition on the instruction of workmen and the education and development of apprentices, which closes April 15. You have great difficulty in developing good mechanics. Are you entirely blameless? Should you not give more attention to their instruction? What are you doing to develop and make good workmen of the younger and brighter laborers and handy men? What results have you obtained from the use of shop demonstrators? Are they not just as essential, or more so, in a day work as in a piece work or bonus shop? This problem of the instruction and development of workmen is vital to the best interests of your shop and road. Then there is the apprentice problem. Much has been written and published about modern apprenticeship on railways. Many shops now have apprentice drawing room and shop instructors. A new field has thus opened up within the past few years. We want to know what problems you have met in the prosecution of this good work and how you have solved them. Are you getting practical results from your efforts to develop the apprentices? Two of the larger systems, the New York Central Lines and the Atchison, Topeka & Santa Fe have elaborate drawing and problem courses and have well equipped schools at each of the larger shops. What are the difficulties met with in this work and how are they overcome? Are these systems a practical success? By the use of traveling instructors the Santa Fe is reaching the smaller shops. But what about the smaller railway systems which cannot handle the work on such a large scale. What methods have they found successful in developing and thoroughly educating the apprentices in the various trades? What does the apprentice boy think about the efforts that are being made in his behalf? How can we exert the proper and best influence on him? Is our duty done when we have taught him how to be a skilled workman, or should we not aim to make a better man and a better citizen of him as well? Should he not be better paid, and can he retain his self respect on the small wage that he is often paid in some shops. Does the railway shop really afford a good opportunity for a bright boy? The education of workmen and apprentices is a vital matter to the railways and to the nation. The questions above are only a few suggestions. There are many other equally important features of this work. We want this competition to be one of the best we have had. The articles should contain from 500 to 1,500 words. A prize of $35 will be given for the best article and $20 for the second best. Articles not awarded a prize will be paid for at our regular space rates if accepted for publication.

SHOP kinks will be the subject of the competition to close May 15. Shop kinks or handy devices of all kinds used in connection with the maintenance and repair of the rolling stock and equipment in charge of the mechanical department will be eligible for entry. A first prize of $50 and a second prize of $25 will be awarded for the two best collections of three kinks. A greater number of kinks may be submitted, if desired, allowing the judges to base their decision on what they consider the best three kinks in each collection. Kinks accepted for publication, but not awarded a prize, will be paid for at our regular space rates.

SO much has been said about the value of time studies that we have asked Mr. Morrison, who has made hundreds of these studies in railway shops to tell just how they should be made. He speaks of one man making a time study and another establishing the standard time or schedule based on it. This could be done in cases where the schedule maker was thoroughly familiar with the machine and the work which was to be done, and had made previous schedules for such work; otherwise it would be necessary to have the time studies made by an experienced man who could not only take a record of the operations and times in which they were done, but who in a broad way could study the machine, the operator and the surroundings with a view to improving the conditions and increasing the efficiency.

IN the articles submitted by our readers in the competitions on increasing shop output and promoting shop efficiency, which have been held during the past year, one factor or phase of the question has been emphasized time and again—the importance of knowing the men and understanding how to handle them. One of the greatest mistakes that has been made by efficiency engineers, and which is considered in the article in this issue on The Mistakes of the Efficiency Men, has been their failure to realize the importance of this factor. Undoubtedly they will deny this, and those in charge of the betterment work which was done on the Santa Fe will point to the elaborate pamphlet which was distributed to all of the mechanical department employees shortly after this work was inaugurated, explaining in detail and illustrating by interesting examples the benefits that the workmen would derive from the installation of the bonus system. It was all very beautiful, and from the standpoint of pure reasoning should have appealed to the men. Why then was there so much opposition to it? Simply because this abstract way of dealing with the men did not and could not appeal to them. The same mistake has been made by railway executives who, suddenly becoming convinced that piece work was a good thing, have issued orders that it be installed within a certain definite period, anywhere from 30 days to six months. Even if all the details could be developed and perfected in such a short time, and men properly trained to install the system were available, it would be impossible to successfully put it into effect, because it takes far longer than this to overcome the prejudices of even a few men in one shop or department, and get them to understand, to realize that the management does not intend to impose on them. Here is where the real executive who understands the human element is absolutely necessary. Without him the work cannot be done successfully. Why have the efficiency engineers failed to realize this?

THE FAILURE OF LOCOMOTIVE CROWN SHEETS.

THE enactment of a federal law for locomotive boiler inspection makes the subject of the causes of boiler failures of timely interest. The most complete and reliable statistics relating to locomotive boiler explosions, failures and casualties are found in the 1910 report of the Master Mechanics' committee on the Inspection of Locomotive Boilers. They cover a period of nearly five years from January 1, 1905, and represent 75 per cent. of the locomotives of the country. When equated for the whole number of locomotives, estimated at 58,000, they will fairly represent the total number of boiler failures which are in the nature of an explosion. The equated figures show a total of 800 failures per year. It should be understood that the figures cover only those failures which resulted in personal injury or death, and the total number of failures, including those in which there was no personal injury, is still larger. Of these, 5 were due to explosions of boiler shells; 68 to explosions of fireboxes, and 700 to damage by burning. Those due to explosions of fireboxes and to damage by burning may be considered as crown sheet failures, since as a rule they are confined to the crown sheet. We, therefore, have a total of 768 failures of crown sheets per year causing personal injury, and an additional number not reported which did not result in personal injury.

The report shows that 98 3 per cent. of the failures were due to low water, and all of these, with the exception of 1.4 per cent., were caused by the neglect of the men in immediate charge of the locomotive to maintain a proper supply of water in the boiler. The only real locomotive boiler explosions which may be charged to the weakness of the boiler are those classed as explosions of the boiler shell, and the average number per year for all the engines in the United States is 5.6, or less than 1/100 of 1 per cent. of the locomotive boilers in service, which is smaller than in any other service, stationary or marine.

The serious damage to locomotive boilers is, therefore, largely due to the failure of crown sheets and, including those which do not cause injury to persons, the average number in the United States per year is now probably 1,000, or about 2 per cent. of the locomotives in actual service, and the number is increasing. Over 98 per cent. of these failures are chargeable to the enginemen. Under such conditions there is little hope for any very substantial improvement by any change in boiler design, by the use of better material, or by more efficient inspection. To make the boiler stronger would only increase the violence of the explosion if it should occur; the practice on some roads is to use crown bolts without heads, so that when the sheet is overheated it will strip the threads and blow down before a very destructive pressure is accumulated. On other roads the front rows of crown bolts are left without heads on the fire side for the same purpose, and then only the front portion of the crown sheet is blown down when overheated. Automatic devices, either to maintain the water supply or to act as an alarm when the proper supply is not provided, have had proper consideration, but it has been determined that such devices are unreliable, and decrease the sense of responsibility of the enginemen.

When so much depends on the regulation of the water level the gage cocks and water glass must be regarded as of prime importance, as they are the only means provided for detecting low water. Considered as safety appliances in a critical position, both of these fixtures should be used as a check on each other. The water glass does not seem to be used to the extent one would expect, although it has been materially improved in a number of ways. It has been made more safe against breakage, and the visual indication is more distinct. The Master Mechanics' Association has frequently discussed the advisability or necessity of using the water glass, and in 1893, in considering recommendations looking to increased safety, adopted a resolution "that the water glass, although a convenience and an additional precaution against low water, was not absolutely necessary to the safe running of locomotives." This was reaffirmed in 1900, but since that time boiler pressures have increased, the conditions of operation are more difficult, and the water glass has been improved.

The testimony of the locomotive builders at the hearing before the House of Representatives committee indicated that about one-half the new locomotives are not equipped with water glasses, showing that their use is by no means general. In its most improved form the water glass is not an expensive fixture, and would pay for itself as an additional insurance against burnt and blown down crown sheets, to say nothing of the greater safety assured the enginemen. The gage cocks should be substantial fixtures, and the openings into the boiler for them, as well as for the water glasses, should be frequently inspected to prevent stoppage by mud and scale.

With such provisions and precautions, the prevention of crown sheet failures due to low water depends entirely on the care and vigilance of the enginemen. Where their own lives are endangered, the occasional failure to maintain a proper level of water in the boiler, like the disregard of signals, may be due in rare instances to mental lapse, but as a rule it can be attributed to the men taking the chance that when the water is out of sight in the glass there may be 3 in. depth still on the crown sheet and that the injector will soon gain on the consumption so that water will presently appear. They find by experience that in some cases the water may be low and the sheet scorched or overheated without blowing down or doing any damage, and this leads to carelessness and willingness to take risks. The failure of crown sheets is, then, as a rule, a personal matter rather than one connected with the construction of the boiler, its strength or its inspection, and the effort to reduce these failures should be directed to the cultivation of greater care and watchfulness on the part of the enginemen.

EFFICIENCY.

THE following quotation from the opening chapter of Frank B. Gilbreth's book on Motion Study,* is deserving of thoughtful attention since it is based on the practical experience of an engineer and employer, whose work as a contractor in the construction of buildings and other engineering work has met with more than ordinary success. "There is no waste of any kind in the world that equals the waste from needless, ill-directed, and ineffective motions. When one realizes that in such a trade as bricklaying alone, the motions now adopted after careful study have already cut down the bricklayer's work more than two-thirds, it is possible to realize the amount of energy that is wasted by the workers of this country. . . . By motion study the earning capacity of the workman can surely be more than doubled. Wherever motion study has been applied, the workmen's output has been doubled. This will mean for every worker either more wages or more leisure." The editor of *Industrial Engineering*, in which Mr. Gilbreth's book was first published as a serial article, was so impressed by it that he decided, as an experiment, to apply some of the principles of motion study to the handling of the outgoing mail in the circulation department. As a result the output of the girls who had charge of folding and enclosing the letters in envelopes, and sealing them, was increased fourfold.

The first stage of motion study is to discover and classify the best practice. To do this Mr. Gilbreth recommends (1), reducing the *present* practice to writing, (2), enumerate the motions used, (3), enumerate the variables which affect each motion, (4), reduce the *best* practice to writing, (5), enumerate the motions used, (6), enumerate the variables that affect each motion. The variables group themselves into three general divisions: Variables of the worker; variables of the surroundings, equipment and tools; and variables of motion. A chapter is devoted to each of these three general divisions in which the principals are outlined; examples are given of the application of

*Published by the D. Van Nostrand Company, New York. Price $2.00. Cloth, 5 in. x 8 in. 116 pages.

the principals, most of the illustrations being taken from the bricklayers' trade.

Is the book of value to a railway officer or foreman, and if so, how? Let us consider the mechanical department which has been singled out by the efficiency engineers as the one which is most in need of scientific management. An important feature, which has been developed and emphasized by the efficiency engineers, is that of making scientific time studies of the different operations in order to eliminate waste motion and establish the proper piece work price, or the standard time in which the work should be completed, if the bonus system is used. Such time studies, if properly made, are invaluable and are just as important in a day work shop as in one operated on a piece work system, for in either one it is essential for those in charge to know that the work is being done efficiently and that the men are delivering a fair return for the wages paid them. To properly make a time study, in our opinion, it should be done by an experienced man who is properly trained not only in observing and timing the various operations that are required to complete a given piece of work, but who is broad enough to study the worker and his characteristics, to analayze the conditions surrounding him, to study the tool he is working on to see if it can be improved, and to take into consideration the many other details that may have some influence, direct or indirect, on his work. To men who wish to tackle the problem in this way Mr. Gilbreth's book is invaluable.

Whether the large saving mentioned by Mr. Gilbreth could ever be made in a railway shop is a question. The large number of different operations that are performed and the number of trades represented would undoubtedly make it inadvisable to go into the detail which would be warranted in a single trade in which the number of operations and motions are limited. However there are great possibilities of improvement in most railway repair shops. Time studies should be made of the more important operations, and standard instructions should be provided for doing the work. In doing this the variables mentioned by Mr. Gilbreth should receive proper consideration. In the classification the variables of the worker includes anatomy, brawn, contentment, creed, earning power, experience, fatigue, habits, health, mode of living, nutrition, size, skill, temperament and training. The variables of surroundings, equipment and tools are appliances, clothes, colors, entertainment, music, reading, heating, cooling and ventilating, lighting, quality of material, reward and punishment, size of unit moved, special fatigue eliminating devices, surroundings, tools, union rules and weight of unit moved. The variables of motion are acceleration, automaticity, combination with other motions and sequence, cost, direction, effectiveness, foot-pounds of work accomplished, inertia and momentum overcome, length, necessity, path, "play for position" and speed.

In developing this study in the bricklayers' trade, Mr. Gilbreth found it advisable to relieve the bricklayer of much work which could easily be done by laborers. Union rules and regulations would not allow this to be done in most trades, and to obtain the best results it will be necessary to re-classify the trades and standardize them. This would prove such a tremendous task, that Mr. Gilbreth suggests that it be done by a permanent bureau, sustained by and under the direction of the government.

Few jobs in a railway repair shop can be compared to the bricklayer's trade. There are, of course, some classes of work where the operations are short and the worker performs them many times a day. In these cases it might be well to carry the motion study to the extreme advocated by Mr. Gilbreth. On the other hand, there are a great number of jobs which are so complicated or extensive that no considerable advantage could be gained by making a study of the exact motions which were required. When the cost of making such a study for the dozen or more trades represented in a railway shop is considered, its folly can be realized; but on the other hand many of the variables suggested by Mr. Gilbreth can be investigated for all the operations and undoubtedly a considerable improvement can be made by rough studies of this kind. It must be kept in mind, however, that there is a certain critical point beyond which this work cannot be carried without a greater expenditure than would be warranted by any returns which might be gained from it. Even in a trade such as the bricklayer's, where the men go through exactly the same motions hundreds of times during the day, it takes much time and patience to induce them to adopt standard methods. They have become so used to doing things in the way in which they learned to do them when apprentices, and have so seldom been rigidly trained to use a certain number of definite motions, that it is a difficult matter to get them to work according to standard methods.

EXCESSIVE WEIGHTS OF LOCOMOTIVE MACHINERY

IN nearly every article that has appeared in the *Railway Age Gazette* relating to steel car design, we have called attention to one important objection which is characteristic of American practice—that of excessive weight. Comparison with foreign practice will show that the weight of such cars has been increased in this country to a point which is not justified either by considerations of safety or good engineering. The excessive weight of cars has naturally led to the requirement of more powerful locomotives, and in the designs for these general dimensions in some instances have reached the maximum limits which roadway clearances will permit. In the construction of these gigantic machines there appears to be little effort made to obtain the most powerful machine with the least weight per horse-power, but, on the contrary, there is a strange pride on the part of both locomotive builders and railways in the production or ownership of the "heaviest locomotive in the world."

The disregard of any relation between weight and strength of materials is seen in the practice of some railways that use wrought iron for driving axles, main and side rods and other parts of the locomotive machinery. The tensile strength of this material never exceeds 45,000 to 48,000 lbs. per sq. in., and the elastic limit is rarely as high as 25,000 lbs. Compare this with machinery steel having an ultimate strength of 85,000 lbs. and an elastic limit of 45,000 lbs.; or with the alloy steels having an ultimate strength of 100,000 to 125,000 lbs., and an elastic limit far exceeding the ultimate strength of the best hammered iron. The alloy steels are now generally used for those parts of machine tools and marine engines that are subjected to heavy stresses, and, in fact, in these fields they have almost entirely replaced the ordinary carbon steels formerly used.

For locomotive machinery it is now possible to obtain at moderate cost steel having an elastic limit double that of wrought iron, and if the areas of sections are made inversely proportional to the elastic limit it should be possible to reduce the weight of the parts 50 per cent. without exceeding the safe working unit strength per sq. in. The reason why there is a distrust of steel by some railways, and also why advantage is not taken of its superior strength in the proportions of locomotive machinery, is partly because the steel has been forged by the railways and has not received proper heat treatment. High carbon steel, when heated and cooled in the same manner as wrought iron, develops internal stresses that are liable to cause failure under loads not exceeding those imposed on the much weaker wrought iron; the crude treatment of steel is thus responsible for the persistent use of iron, which requires the sections to be much larger and the weight of the finished parts considerably greater than necessary.

Steel crank pins failed frequently by fracture when first introduced; on some railways the remedy applied was to increase the diameter at the hub fit; others retained their standard sizes and had the pins forged and given proper heat treatment at the steel works. This will largely explain why on most lines locomotive

steel forgings have increased in size far beyond the strength requirements. The purchasing agent and the master mechanic are to blame where ordinary steel is bought for rods and pins and forged in the railway smith shop in order to save the extra expense for special steel forged and treated at the steel works. The specifications for new locomotives should also take account of this difference between home-made and specially treated forgings, and the designs should show a closer relation between the strength of the material and the area of section than is ordinarily found in present practice.

The disregard for this relation is especially to be deplored in the excessive weights of reciprocating parts. The difference between American and foreign practice in this respect may be illustrated by a comparison between the weights of the pistons, crossheads and main connecting rods of a recently designed American compound locomotive and the corresponding parts of a French balanced compound of the same class and capacity.

	Weight in Pounds.		Per cent. French to
	American.	French.	American
High pressure piston and piston rod.....	332	198	60.
High pressure crosshead and pin.....	310	238	77.
Low pressure piston and piston rod.....	481	344	71.5
Low pressure crosshead and pin.....	310	238	77.
High pressure main rod.....	668	310	46.5
Low pressure main rod.....	623	440	70.5
Total	2,724	1,768	65.

The weight of the reciprocating parts of the French locomotive, including the entire weight of the main rod, is only 65 per cent. of the corresponding parts of the American locomotive of the same cylinder capacity. The disturbing effect due to the inertia of the reciprocating parts at high speeds reaches large proportions when these parts are unnecessarily heavy. Considering the weight of the front end of the main rod and the other weights as given, at a speed in miles per hour equal to the diameter in inches of the drivers, the force due to inertia is about 10 tons more at the end of each stroke in the American engine than in the French engine, due to this unnecessary increase in the weight of the reciprocating parts.

The same disregard of the use of materials of high tensile strength for reciprocating parts is seen in the design of American piston heads. In marine practice and in French locomotives these are made of forged steel having a tensile strength of 85,000 lbs. or more per sq. in., while in American practice they are usually made of cast iron with an average tensile strength of 20,000 lbs. or less. For a boiler pressure of 200 lbs. a 15-in. piston of marine design weighs 91 lbs.; for the French locomotive, 104 lbs.; while the American locomotive cast iron piston weighs 218 lbs. Even in the larger diameters of pistons, cast iron is usually retained, and the relation of the weights is as follows for a 25-in. piston: Marine design, 193 lbs.; French locomotive, 233 lbs.; American locomotive, 362 lbs. The 15-in. marine piston weighs only 42 per cent. and that for the French locomotive only 48 per cent. of that for the American locomotive, while the 25-in. marine pistons have only 53 per cent. and the 25-in. French locomotive pistons only 65 per cent. of the weight of the American piston of the same diameter.

The Pacific type locomotive now in general use for fast heavy express service has a large margin of weight on drivers beyond that required for adhesion, and, as there is ample opportunity for a reduction in its weight this improvement should commence with the reciprocating machinery. The designs for these parts should be revised so that advantage will be taken of the greater strength of alloy steels.

When the Walschaert valve gear was first introduced in this country strong claims were made for the reduction in weight as compared with the Stephenson gear, but that merit has been long forgotten, and the more recent designs for the former appear to show little regard for economy of material and good proportion. The housings for the pin-connected valve gear are also as formidable in size. The trailing trucks with outside bearings for both Atlantic and Pacific type engines are complicated and heavy to a degree wholly unwarranted by necessity, and here also there is opportunity for a modified design which shall be much simpler and lighter.

The proportion of dead weight in both locomotives and cars of American design has increased enormously in recent years, and when its first cost, the expense for repairs, and the cost of hauling excess weight at high speeds are considered, there will be found good reason for a wholesale revision of the designs for American rolling stock so as to make them lighter but amply strong. We have referred to some of the principal locomotive details which should be reduced in weight, but, with the exception of the boiler, the same fault extends throughout the whole engine.

MECHANICAL ARTICLES DURING FEBRUARY.

THE following articles of special interest to mechanical department readers, and to which Shop Number readers may wish to refer, have appeared in the weekly issues of the *Railway Age Gazette* since that of February 3:

Locomotive Boiler Inspection Legislation. Editorial comment on the new bill, as amended and passed. That it is fairly satisfactory is due largely to the fact that the railways did not oppose legislation on the subject, but insisted that any law that might be enacted should be fair and wise; to accomplish this they tendered the services of their experts.—February 10, page 266.

Nickel and Chrome Alloys for Chilled Iron Car Wheels. Robert C. Totten, in a communication, directs attention to the great improvement in cast iron car wheels due to the use of these alloys.—February 10, page 268.

Scientific Management. F. Lincoln Hutchins, in a communication on this subject (February 10, page 268), severely criticized the article on The Mistakes of Efficiency Men in the issue of February 3. Mr. Hutchins' letter was replied to in detail by the author of the above-mentioned article in the issue of February 17, page 311. Editorial notes on these communications appear on pages 265 of the issue of February 10 and 307 of the issue of February 17. Other communications on the subject appeared on pages 310 and 311, February 17, and page 344, February 24.

The Supply Department. The last of the series of articles by H. C. Pearce, general storekeeper of the Southern Pacific, deals with the system of buying under contracts or agreements and explains how to install the plan without disorganization; also considers the weakness and strength of the present supply system.—February 10, page 276.

Mallet Locomotive with Articulated Boiler Rebuilt from Old Power. By M. H. Haig, mechanical engineer, Atchison, Topeka & Santa Fe. A detailed description of an experimental Mallet rebuilt from two Prairie type locomotives. A flexible boiler with a ball joint is used and is said to be giving satisfactory results.—February 10, page 279.

The Repair Track and Its Relations to Traffic. A brief article from the yard-master's viewpoint.—February 10, page 290.

Federal Boiler Inspection. The value of the new law will depend largely on the ability and wisdom of the inspector general who will have charge of its administration.—February 17, page 308.

Locomotive Smoke in Chicago. The department of smoke prevention in Chicago has made a scientific study of this subject. The results were given in a paper read before the Western Society of Engineers by Paul B. Bird. An abstract of the paper appears in the issue of February 17, page 321.

Pacific Type Superheater Locomotive; Chicago & North Western. These locomotives, which were placed in service last July, have given such good results that superheaters have been specified for 30 of an order of 50 consolidation locomotives which are now being delivered to this road. A description of the locomotive and superheater appears on page 325 of the February 17 issue.

New York State Boiler Inspection. Editorial comment on the results which have been obtained by the regulations in force in New York state. This sort of inspection is of value to both the railways and the public and the expense to the latter is limited to the salaries and traveling expenses of two men.—February 24, page 342.

Brooks Spark Arrester. This device, which is described in detail, has been tried out on 75 locomotives on the Chicago, Milwaukee & Puget Sound and has given such good results that it is being applied to the other locomotives as fast as opportunity affords.—February 24, page 348.

Mallet Locomotives on the Santa Fe. The Baldwin Locomotive Works has built two Mallet locomotives for this road having flexible boilers; also 38 with rigid boilers of the separable type. One of the flexible boilers has a bellows type connection and the other a ball joint arrangement.—February 24, page 351.

Superheated Steam in Locomotive Service. A liberal abstract from a report on this subject made for the Carnegie Institution at Washington by Dr. W. F. M. Goss.—February 24, page 357.

Steel Sleeping Cars for the Chicago, Milwaukee & St. Paul. Fifty-nine of these cars have been received from the Pullman Company.—February 24, page 359.

THE MISTAKES OF THE EFFICIENCY MEN.*

BY ONE WHO HAS WORKED WITH THEM.

III.

Neglect of the Human Element.

Criticism of the theories of the efficiency men may be more or less a matter of opinion, but criticism of methods and practices, based on actual results, and backed up by the evidence of practical men who have intimate knowledge of the working of the so-called efficiency systems, ought to bear weight. And it is not to their credit that the efficiency men dismiss such evidence with scant consideration. Of the mistakes that have been made some are recognized so universally that it is to be wondered at that the efficiency men themselves fail to appreciate and correct them—so far reaching are they in their effects. Among these mistakes, perhaps none has been more apparent or more surely fatal than their failure to recognize the human element, in other words, their ignorance, at least in practice, of human nature. The millennium has been a long time coming, but most of us are willing to accept a little less than perfection, as we understand it, because we have learned by experience that perfection is an ideal to be striven for—seldom to be reached. There are practical and visionary idealists; the one appreciates the limitations of men and the frailties of human nature without sacrificing his ideals, the other, living apart in a world of fancy, can be satisfied only by perfection—and therefore forever remains unsatisfied.

This fundamental mistake is not confined to the relations of efficiency men to the rank and file of workmen; it extends alike to foremen, superintendents, managers and those in executive authority. How the efficiency men can expect to receive a favorable audience for presenting their cause after following the course they usually pursue is hard to imagine. What has been their general attitude toward these various classes? They have criticized railway executives because their philosophical discussions have not been taken seriously, forgetting that they are men of action rather than of words. They have charged railway and industrial managers with incapacity in dealing with intricate problems that have resulted from the growth and consequent complexity of their business, ignoring the power that comes only from intelligent and intimate knowledge of actual conditions. They have referred to superintendents, foremen and others in direct charge of operations as "of the old school," and to their management as "rutty," because they have depended on a practical experience and an ability to handle man rather than on artificial systems, to secure permanently good results, forgetting that the standards attained by such men have not been generally improved upon under any so-called efficiency system. They have substituted for comparatively simple methods of determining costs and earnings, complicated and theoretical schemes without preparing the way for a clear understanding of their elements. In all of this, however worthy their object and however correct their reasoning, they have depended more on the force of logic to carry their plans to a successful conclusion than on a reasonable attitude which takes into account the elements of human nature that are common to the large majority of men. They have talked and written too much, and it is not surprising that the term "scientific management" has been given little serious thought in certain quarters.

One of the leading efficiency men has stated that "it is not men or materials, money, machines and methods that count, but more potently theories and principles." We shall not quarrel with them regarding the principles that underlie all successful industrial and railway management. Efficiency men are not alone in recognizing them. Abstract reasoning has its place, but in itself cannot make two blades of grass grow where one grew before, nor turn the wheels of industry. Great as imagination is, and however necessary a part it plays in broad and comprehensive plans for the improvement of the human race, it must be translated into the concrete before it is really vital. And it is not true that what is correct in theory is likewise always correct in practice. Scientific management of railways and industrial plants is not a system of philosophy; it is common sense applied to the working out of the problems that cannot be solved except through men—practical men, men who *know*.

A number of years ago one of the now leading efficiency engineers was engaged in a large industrial plant to introduce a piece work system. For two years he labored. Stop-watch in hand, he timed the various operations and tabulated the results. His attitude toward the workmen was impersonal. He was a scientist (?) in his laboratory. He was a man apart. The men around him recognized him as such. Lacking their confidence, co-operation was impossible. But from the standpoint of the efficiency engineer this was unnecessary; his faith was in his theories and principles. Consequently, when he appeared in the shop and began his observations, machines would often be slowed down with loss of output or speeded up with damage to tools. Every device known to the various trades was resorted to to block him at each turn. The result was that after two years of effort the establishment of a satisfactory piece work system was as far from realization as it had been when the task was started. Then a practical man was called in. He acquainted himself with the machines and their capacity. He mingled with the men and gained their confidence. He explained that the object in view was two-fold, to increase the output at a reduced cost per unit to the company, and at the same time to enable the men to earn more. Within six months he had accomplished results that the efficiency man had spent two years in an effort to secure. Why? Because he appreciated the importance of the *man* element.

Yet they tell us that practical men follow the rule of thumb, that they have not had the time and do not possess the ability to analyze closely the successive steps in the almost myriad operations of a large shop, that because of a lack of scientific knowledge they are not competent to determine proper methods of work or secure the best results from operation. It is undoubtedly true that many practical men lack the peculiar qualities required by the efficiency engineer. Not a few successful men would be more successful if they possessed more fully the faculty of analysis and co-ordination and had a more lively appreciation of the theory of scientific management. But are the efficiency men assisting them in this direction? Rather, are they not practically ignoring the experience of practical men in their endeavors to establish the efficiency system, or to clarify the atmosphere surrounding it? Do they not give too little credit to the capacity of such men—inherent in some, acquired by many—to handle men, to convince them of their mistakes, to gain their sympathy and to establish that *esprit de corps* without which no organization is efficient? Under these conditions, efficiency engineers should not be surprised that practical men view with distrust their efforts in fields in which they have had no actual training. While there is perhaps no little prejudice back of such an attitude, it is nevertheless a real situation, and the success or failure of many an attempt in scientific management, as interpreted by the efficiency men, has been foreshadowed by the extent to which the confidence has been secured of the men behind the guns.

An understanding of the psychology of the crowd as represented by a shop filled with workmen, possessed in large measure by most successful factory and railway managers, master mechanics, round house and shop foremen, cannot be replaced by a theory of management nor ignored with impunity in introducing efficiency methods. Of two men entering a shop apparently equally equipped, one was found to be analytical and critical both in respect to the details of his work and his

*The first article appeared in the January 6 issue and considered the extravagant statements and claims made by efficiency engineers. The second article, in the issue of February 3, considered the failure of many of their theories when brought to the test of practical application.

fellow workmen, but lacking the magnetism that makes for leadership. The other, with less analytical ability and often wrong in his theories, possessed a personality that gave him an influence over the men around him. Which, naturally, became the leader, afterwards the foreman, then the superintendent? Such men, by the law of selection, represent the great majority of those who manage our railways and superintend our industrial and railway shops. Whatever their failings, they are to be reckoned with.

Why have so many of the plans of the efficiency men miscarried? It is not because the principles of scientific management are wrong. The cause is manifold: high overhead costs, impracticable methods, untrained men, impossible standards, labor difficulties, lack of harmony, distrust, impatience for results, but chiefly because the efficiency man has considered his system as a thing apart from knowledge gained through experience, depending for success not on men, but "more potently on theories and principles." Gaining the confidence of the workmen is often subordinated to the desire to prove the correctness of his theories, irrespective of the attitude of those whose interests are most intimately concerned.

An eminent efficiency engineer was retained to establish the efficiency system in a large and important shop. A reduction in costs of at least 30 per cent. had been assured after he had made the usual special investigation. At the end of a year, although certain somewhat spectacular reductions in cost had been effected, which were cited as evidence that the system was making good, it was found that the cost per unit had remained practically the same. The efficiency system was in disfavor. The confidence of the men—the first essential—had not been gained. Early in the following year a new superintendent was employed. He made the best use he could of the efficiency methods, but at the end of the second year the reduction in costs has been very slight. The efficiency system was in greater disfavor. Overhead costs had increased and practically offset any reductions that had been attained in direct costs. Thereupon the efficiency system was discontinued. At the end of the third year it was found that costs had been reduced more than three times as much as the combined reductions of the first two years. What caused the change? Ample time—much longer than had originally been called for—had been given to establish the efficiency system. The principles and the theories were both present. A factor had been absent, however, without which the system was but an empty shell—a man who understood men. The new superintendent knew how to bring men around to his point of view. He gave fair treatment and received like treatment in return. He recognized their abilities as well as their failings. He was firm in discipline but impartial. It would be incorrect to say that he had no system. He could not have succeeded without it. But his was a system based on practical experience, not evolved in the closet by a theorist. This was not all—he understood human nature and was able to accomplish in twelve months what the efficiency engineer would never have accomplished.

While many a shop foreman, superintendent or master mechanic may have no proper appreciation of the beauties of the philosophy of efficiency, may be unable to follow the line of reasoning of the efficiency men, may be mistaken in his belief that his men are more efficient than the "assays" have shown, and may have much to learn, he has usually reached his position because of certain qualifications possessed in greater measure by him than by the other men with whom he has been associated. And in introducing efficiency methods in his department it is a fatal mistake to omit the first essential, his good will, because almost invariably except through him the good will of the men cannot be secured. Too often the system is worked out with insufficient consideration being given to the men most closely affected; whose suggestions given with the best of intentions are ignored. Little pains are taken to explain the details of the system to those who must understand and favor it if it is to succeed. The word has gone out that the old system must give way to the new, and short shrift is given to the opposition. Thus it happens, that while this is farthest from their thought, the attitude of the efficiency man and that of the foremen and workmen are antagonistic. *Lacking the initial meeting of the minds and agreement on essentials, efficiency plans are foreordained to fail.*

A leading efficiency engineer has recently said that their claims have been "received with astonishment, skepticism, ridicule and anger because they have been misunderstood." In all fairness, it should be said that they are not *intentionally* misunderstood. It would be untrue to say that the efficiency men are to blame for all misunderstandings that have arisen. But they should put themselves in the other fellow's place, and perhaps they would be able then the better to appreciate his point of view. Instead of accepting the evidence of practical men, those who work and those who direct alike, they insist that all criticism is prejudice and assume the attitude of *laissez faire*—"let us alone." There are weaknesses in their structure, and the efficiency man is wise who gives greater place in his system to the greatest of all studies—*the study of man.*

BOILER SHOP TOOL ROOM PRACTICE.

BY L. M. STEWART AND R. B. VAN WORMER.
Foreman Boiler-Maker and General Foreman, Atlantic Coast Line, Waycross, Ga.

A systematic and satisfactory method of handling and maintaining the small tools in the boiler shop is in effect at the Waycross, Ga., shop of the Atlantic Coast Line. Each boiler-maker and boiler-maker apprentice has a number for checking in and out. When first employed he gives his name and check number to the tool room keeper, who makes a record of it, and furnishes him with six tool checks and a small iron tool box with a number on it corresponding to the check number. The tool room man sees that each tool box is at all times equipped with three flat chisels, three cape chisels, two round nose chisels, one center punch, one 12-in. monkey wrench, one standard alligator wrench, one hand hammer, one electric light extension cord and lamp, three drift pins and two hand calking tools. The tool boxes of men assigned to certain classes of special work are also temporarily supplied with the tools that may be required. The tool boxes are returned to the tool room every Saturday night; they are checked over, and all broken or badly worn tools are replaced with repaired or new tools.

All other tools required by a boiler-maker, including pneumatic tools, are checked out under the tool check system. The number of checks furnished to one man is limited to six in order to prevent any one workman having more tools than actually required, and at the possible expense of other work. If he should require additional tools he can exchange with some of the six tools already checked against him. This reduces the number of tools required to a minimum, and their time in actual service to maximum. No boiler-maker or apprentice is allowed to keep any tools in his clothes locker or private box, as such practice keeps a large number of tools out of service, which cannot be easily located. The boiler-maker has his helper carry the six checks, which are secured to a ⅛-in. brass wire safety pin that can be fastened to the jacket. The boiler-maker sends his helper for the tools and holds him responsible for the checks. The boiler-maker is, however, held responsible for both the tools and the checks.

All pneumatic tools must be returned to the tool room every night. The hammers are stored in a tank of oil over night. The air motors are placed on suitable racks and every morning both the air drills and the hammers are thoroughly oiled for service. Every small or portable tool used in the boiler shop is kept in boiler shop tool room. All wedge bars and holding-on bars are stored on a rack adjacent to the tool room and under supervision of the tool room keeper. We have adopted a stand-

ard make of air hammer and air motor, and keep a small number of repair parts in stock at the tool room to facilitate rapid repairs to all air tools, including those sent in from outlying points.

We have experienced decided success in driving staybolts with a long stroke air hammer and find it results in the saving of time, as well as giving excellent results in bad water districts.

STOREHOUSE FOR FREIGHT CAR MATERIAL.

FIRST PRIZE ARTICLE IN CAR DEPARTMENT COMPETITION.

BY ROBERT G. BENNETT.

Motive Power Inspector, Pennsylvania Railroad, South Pittsburgh Shops, Pittsburgh, Pa.

An economical and efficient means of storing and accounting for the material for freight car repairs was recently installed at Thomson, Pa., on the Monongahela division of the Pennsylvania Railroad. The enclosure in which the material is stored is somewhat similar in outside appearance to a stockade, and is 40 ft. wide and 85 ft. long, and constructed of rough hemlock boards. The floor is made of old car sills which extend 4 ft. beyond the side walls on the outside so that material may easily be trucked to and from the storehouse. A plan of the enclosure is shown in Fig. 1, and the details of the construction of the storage bins in Fig. 2. As shown on the plan, access may be had to the enclosure at two points only, one of which is used for delivering the material to the workmen and the other for receiving material from the cars. A roof is provided over the bins, which extend along the four sides. These bins contain the smaller material, a large part of which it is necessary to protect from the weather and keep in a dry place. A small office building, 8 ft. 2 in. by 8 ft. 2 in., is placed near the center of the enclosure. The upper portion of the four sides of this structure contains a large amount of window area, as indicated on the drawing, thus enabling the man in charge, while doing such clerical work as may be necessary, to see that the workmen are promptly waited on at the delivery counter.

The bins along the four side walls are divided into sections, designated by the letters A, B, C, D, E and F; the remaining space in the enclosure is divided into two sections, G and H. An iron rack, with a roof, and a knuckle rack are also placed within the enclosure, as indicated. Sections G and H are used for storing such material as journal boxes, stake pockets, brake shoes, etc., which cannot conveniently be placed in the bins and which are not greatly affected by climatic conditions. Section I on the outside is used for storing couplers and section J for brake beams and couplers. This material is too heavy to be passed over the counter and is kept outside on either side of the entrance where the attendant can supervise its distribution.

The class of material that is kept in each of the sections of bins is shown in Table 1. In order to accurately designate the

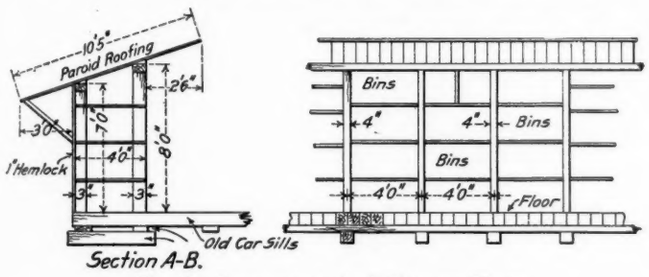


Fig. 2—Arrangement of Storage Bins.

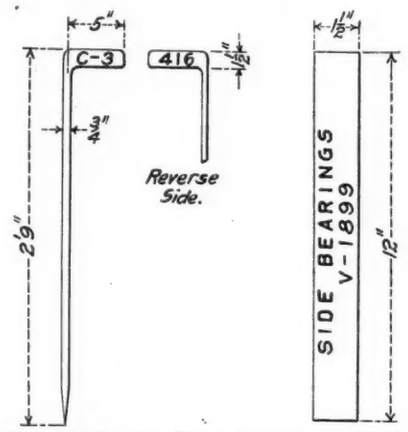


Fig. 3—Marking Stake for Floor Spaces and Label for Bins.

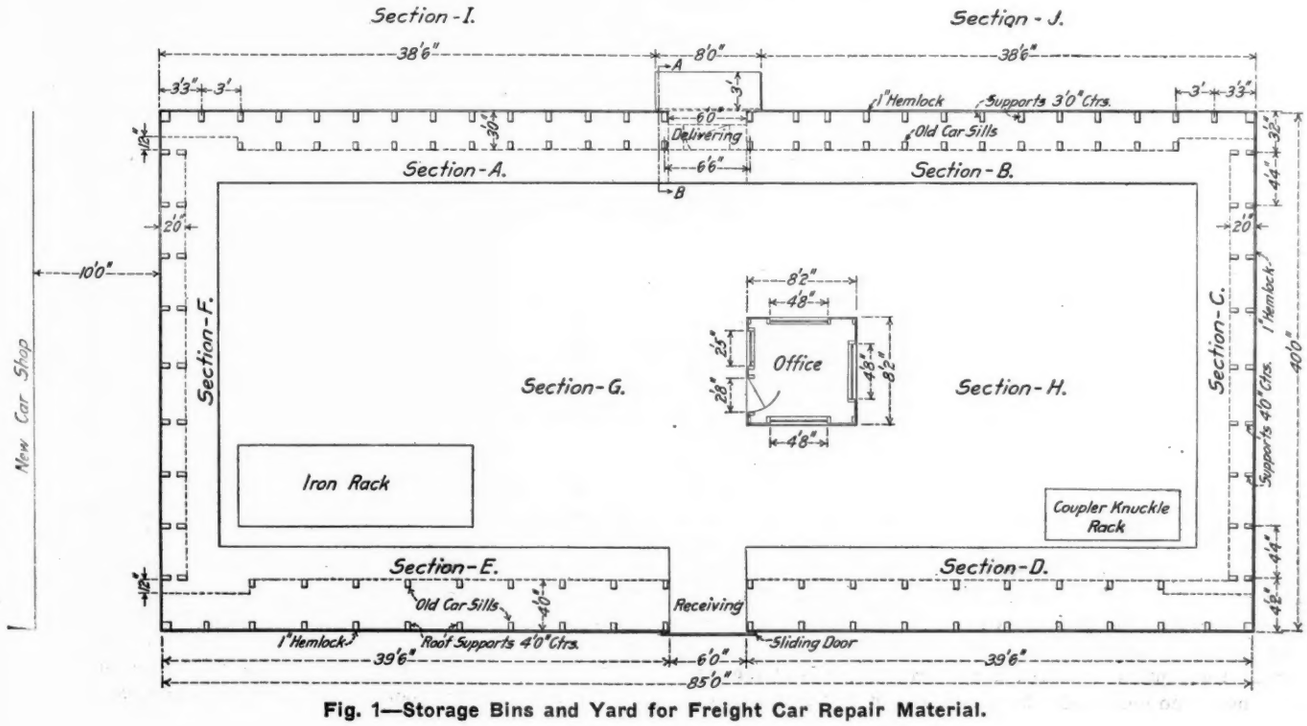


Fig. 1—Storage Bins and Yard for Freight Car Repair Material.

location of material, each section is divided into rows, and the bins in each row are numbered consecutively. Table No. 2 shows the rows and bins into which section A is divided and the class of material that is carried in each bin. Table No. 3 shows the rows and spaces into which the floor section H is divided and the material that is kept in each space. A tin label, of the dimensions shown in Fig. 3, is used for marking the bins.

use of the freight car pool sheet shown in Fig. 4. A separate sheet is used for each section and covers a period of one month. The sheet is fastened to the board shown in Fig. 5 by the thumb tacks A, and is held in place at the lower end by the plate washers B, which are tied to the screw eyes at the top of the board by cords. During inclement weather and at night the boards are detached and placed in the office. Each board is

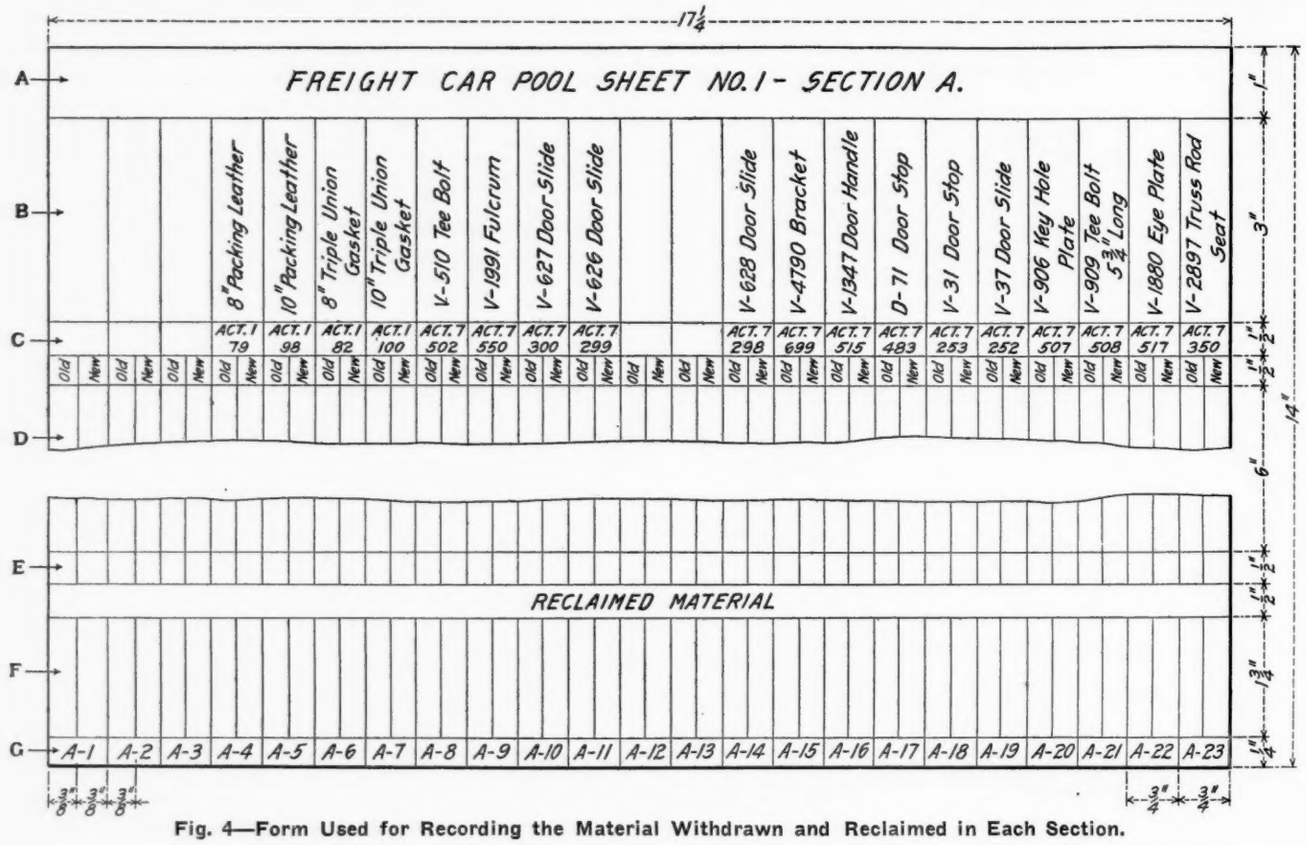


Fig. 4—Form Used for Recording the Material Withdrawn and Reclaimed in Each Section.

It is tacked at the top of the bin and the kind of material and the casting number are painted on it. A flag marker, as shown in Fig. 3, is used for indicating the floor spaces. On one side of the marker the row and bin number are painted, and on the opposite side the stock book reference number.

The accounting of the material in each bin is done by the

located near the center of its respective section; those for sections G and H are placed on the side of the office building nearest the section to which they refer. The board is shown in its working position in Fig. 5. On the pool sheet, Fig. 4, the sheet number and section are shown in space A; the contents of the bins in space B; the inventory account number and stock book

Table 2.

MATERIAL AS ARRANGED IN SECTION A.

Bin.	Row A.	Row B.	Row C.	Row D.	Row E.	Row F.
1.	Empty.	⅜-in. gas pipe elbows.	1¼-in. service elbows.	⅜-in. unions.	⅜-in. leather gaskets.	⅞-in. nut locks, single.
2.	Empty.	½-in. gas pipe elbows.	1¼ in. x 1 in. elbows.	½-in. unions.	½-in. leather gaskets.	1-in. nut locks, single.
3.	Empty.	1-in. gas pipe elbows.	⅜-in. sleeves.	1-in. unions.	1-in. union gaskets, Pc. No. 1778.	1⅛-in. nut locks, single.
4.	8-in. packing leathers.	1¼-in. gas pipe elbows.	½-in. sleeves.	1¼-in. unions.	1¼-in. union gaskets, Pc. No. 2183.	1⅜-in. nut locks, single.
5.	10-in. packing leathers.	⅜-in. service elbows.	¾-in. sleeves.	1-in. triple unions.	Air hose gaskets.	1¾-in. nut locks, single.
6.	8-in. triple union gaskets.	½-in. service elbows.	1-in. sleeves.	1¼ in. x 1 in. bushings.	¾-in. nut locks—2-hole.	⅝-in. nut locks for dfts.
7.	10-in. triple union gask's.	1-in. service elbows.	1¼-in. sleeves.	1¼-in. triple unions.	⅝-in. nut locks—2-hole.	Empty.
8.	V-510 tee bolts.	V-494 draft supports.	V-1649 journal bearings.	Second-hand bearings.	.....	.....
9.	V-1991 fulcrums.	V-486 draft supports.	V-360 journal bearings.	V-3244 journal bearings.	.....	.....
10.	V-627 door slides.	V-2878 double sheaves.	V-3243 journal bearings.	V-2682 journal bearings.	.....	.....
11.	V-626 door slides.	V-149 brake shaft hgrs.	V-2540 journal bearings.	V-2752 journal bearings.	.....	.....
12.	Empty.	V-3212 brake shaft hgrs.	Empty.	Empty.	.....	.....
13.	Empty.	Brake heads, National hollow.	V-1407 Christie brake heads.	V-1331 truss rod seats.	.....	.....
14.	V-625 door slides.	V-142 ratchet wheels.	V-1899 side bearings.	V-593 truss rod seats.	.....	.....
15.	V-4790 brackets.	V-4123 ratchet wheels.	V-844 side bearings.	V-1330 truss rod bridges.	.....	.....
16.	V-1347 door handles.	Empty.	V-848 Graham draft followers.	Empty.	.....	.....
17.	D-71 door stops.	V-532 box washers.	Empty.	Westinghouse friction draft gears comp't.	.....	.....
18.	V-39 door stops.	V-660 box washers.	Empty.	Empty.	.....	.....
19.	V-37 door slides.	.....	.....	.....	.....	.....
20.	V-906 key-hole plates.	.....	.....	.....	.....	.....
21.	V-909 tee bolts.	.....	.....	.....	.....	.....
22.	V-1380 eye bolts.	.....	.....	.....	.....	.....
23.	V-2897 truss rod seats.	.....	.....	.....	.....	.....
24.	V-3405 shaft bearings.	.....	.....	.....	.....	.....
25.	V-3406 operating levers.	.....	.....	.....	.....	.....
26.	V-4337.	.....	.....	.....	.....	.....
27.	V-905 door hasps.	.....	.....	.....	.....	.....
28.	V-4791 brackets.	.....	.....	.....	.....	.....
29.	V-2744 door handles.	.....	.....	.....	.....	.....

reference number in space C; the amount of material withdrawn, and whether old or new, in space D; the totals for each column in space E; the amount of each class of material which

TABLE 1.

GENERAL ARRANGEMENT OF MATERIAL IN ALL SECTIONS.

Section.	Contents.
A	See itemized table of contents.
B	Small iron castings, carriage bolts, nuts, plate and cast washers, wire nails, lag screws, and spring cotters.
C	Square head bolts.
D	Small iron castings, small W. I. pieces, bolts and nuts.
E	Air brake material, small W. I. pieces, chain, and pipe fittings.
F	Small W. I. pieces, small iron castings and rivets.
G	Iron castings, large W. I. pieces, iron rod, and pipe.
H	See itemized table of contents.
I	Couplers.
J	Brake beams and couplers.

is reclaimed in space F, and the row and bin number in which the material is stored in space G. This sheet replaced the old card system and offers a convenient means by which the division storekeeper may check the consumption of material at the re-

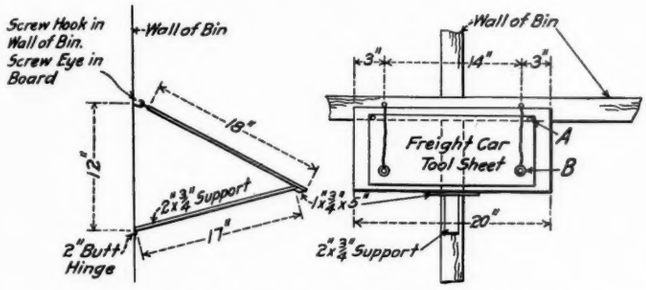


Fig. 5—Detachable Support for Freight Car Pool Sheets.

pair point as the pool sheets are forwarded to him at the end of each month.

The car repair yard at Thomson handles from 80 to 100 cars in a day of 10 hours, and two men are required for handling the material in the storehouse. One is in charge and does such

TABLE 3.

MATERIAL AS ARRANGED IN SECTION H.

Bin.	Row A.	Row B.	Row C.	Row D.
1.	V-2751 journal boxes.	Single stake pockets.	V-5470 brake shoes.	R. E. Janney knuckles.
2.	V-2539 journal boxes.	St'd chafing irons.	V-173 brake shoes.	R. E. Janney knuckles.
3.	V-6091 journal boxes.	3½ in. x 5 in. stake pockets.	Gr. sill steps.	Detroit knuckles.
4.	V-2766 journal boxes.	4 in. x 4 in. stake pockets.	Gl. sill steps.	Emergency knuckles.
5.	V-1646 journal boxes.	.....	Empty.	Empty.
6.	V-6092 journal boxes.	.....	8-in. cylinder and 8-in. reservoir combined.	Empty.
7.	.....	.....	10-in. reservoirs, Pc. 21838.	Empty.
8.	.....	.....	Kelso knuckles.	Empty.
9.	.....	.....	Kelso knuckles.	Tower knuckles.
10.	.....	.....	Pitt knuckles.	Tower knuckles.
11.	.....	.....	Melrose knuckles.	Empty.
12.	.....	.....	Latrobe knuckles.	Empty.
13.	.....	.....	Latrobe knuckles.	Climax knuckles.
14.	.....	.....	Buckeye knuck's.	Empty.
15.	.....	.....	Monarch knuck's.	10-in. cylinders, Pc. 4868.
16.	.....	.....	Monarch knuck's.	Empty.
17.	.....	.....	Chicago knuckles.	Gla. sill steps.
18.	.....	.....	Munton knuckles.	Ge. sill steps.
19.	.....	.....	Major knuckles.	Empty.
20.	.....	.....	Gould knuckles.	.....

clerical work as is necessary and keeps up the stock; the other distributes material at the counter. When giving out material the attendant makes the proper entry in column D on the pool sheet. Good material, which can be picked up in the yard and returned to the storehouse, is placed in the proper bins and entered on the pool sheets under "reclaimed material." At the end of the month these sheets are totaled and checked with the stock books. The balance, which is computed, should agree with the supply in the bins. The proper handling of freight car material at outlying points, so as to keep a thorough account of its consumption as well as to keep down the stock, is an important item in economical management, and this method of housing, caring for and accounting for material offers a ready and cheap solution of the problem.

CAR INSPECTORS' KINKS.

SECOND PRIZE ARTICLE IN THE CAR DEPARTMENT COMPETITION.

BY A. G. PANCOST, Draftsman, Elkhart, Ind.

The following two kinks may be used to advantage by car inspectors. They are simple but greatly increase the efficiency of the inspector.

CAR INSPECTOR'S PINCHERS.

Few tools used by car inspectors can be put to as many uses as the pinchers shown in Fig. 1. The tool weighs very little

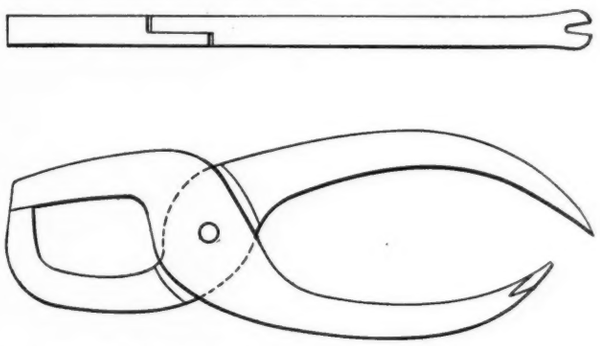


Fig. 1—Car Inspector's Pinchers.

and may be carried in the pocket without inconvenience. The two parts are forged from a good grade of tool steel and may be polished if desired. The end of one part of the handle is tapered to a sharp point, while the other is flattened and shaped for use in pulling tacks. The tool as it is used for removing a rubber gasket from an air or steam hose is shown in Fig. 2. Every inspector is familiar with the trouble that is experienced

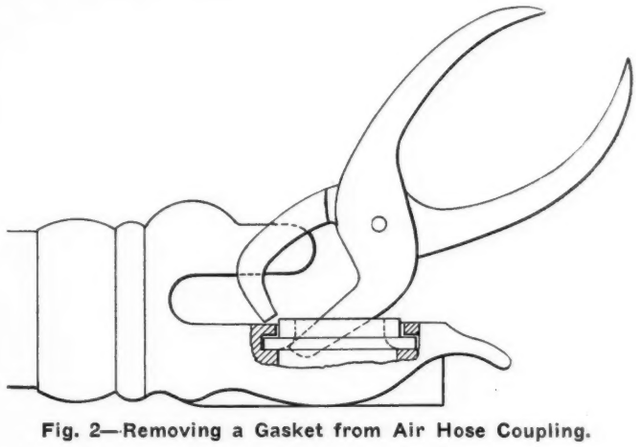


Fig. 2—Removing a Gasket from Air Hose Coupling.

in removing these gaskets, especially old ones, which often stick in the recess. Should any of the pieces of gasket or dirt or scale remain in the recess, they can easily be removed by inserting the sharpened end of the handle and scraping them off. In placing a new gasket in the coupling it is necessary to double it up and force it through the opening, which is, of course, considerably smaller than the overall diameter of the gasket. In some instances the gasket does not fit properly in the recess and kinks up. By placing the nose of the pinchers in the opening in the gasket, as shown in Fig. 3, and turning the tool around several times, pressing down at the same time, the gasket may be spread and forced into the proper position. In replacing

broken glass on cars it is often necessary to remove moldings. This can be done without injury to the molding by the use of the pinchers, as shown in Fig. 4. The tack puller end of the handle can be used to pry up the molding and loosen the brads. The latter can then easily be pulled out. Car inspectors

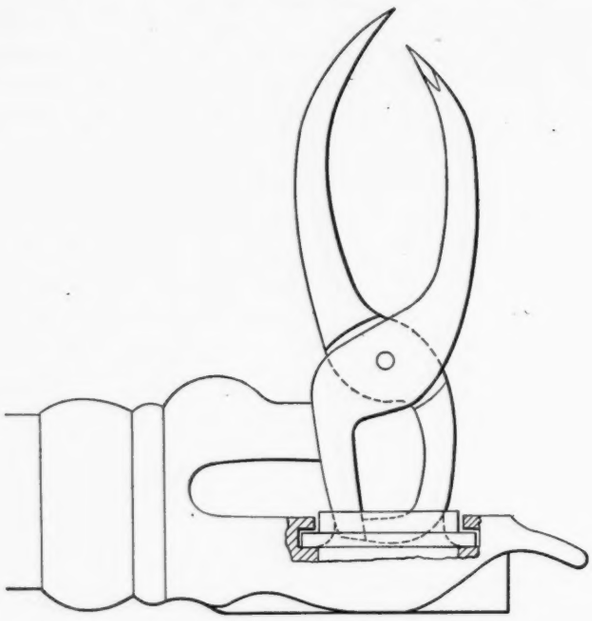


Fig. 3—Forcing Gasket to Seat Properly.

do not like to carry tacks with them. When equipped with these pinchers it is not necessary to do so, for they can easily remove a tack from the side of a car at any time it is needed. Flat places are left on the pinchers so that they can be used to advantage in driving tacks.

APPLYING BRAKE HEADS.

Diamond Special brake beams have heads arranged as shown in Fig. 5. The head is held to the beam by a cast lug, which is

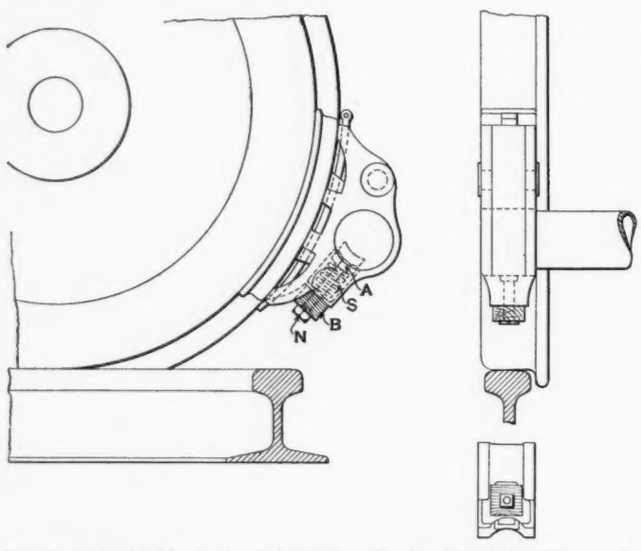


Fig. 5—Simple Method of Applying Brake Head to Diamond Special Brake Beam.

forced into a recess in the beam by a strong spring. The position of the lug when the head and beam are locked is shown by the dot and dash line on the sketch. The usual method of releasing the spring S is to turn the nut N a distance of about 1¼ in. along the threaded end of the bolt, which is fastened to the lug. Even if the nut was in such a position that it could easily be gotten at, this is a tedious job; but considering the angle at which it is set and the short distance between it and the top of the rail, it is almost necessary for a man to lie flat on his back to adjust it. A simple method has been devised for overcoming this inconvenience, so simple that it is strange that it was not discovered sooner. The heads are received from the maker with the lug drawn back ready to slip over the beam. When these are received a wedge is driven in at X to hold

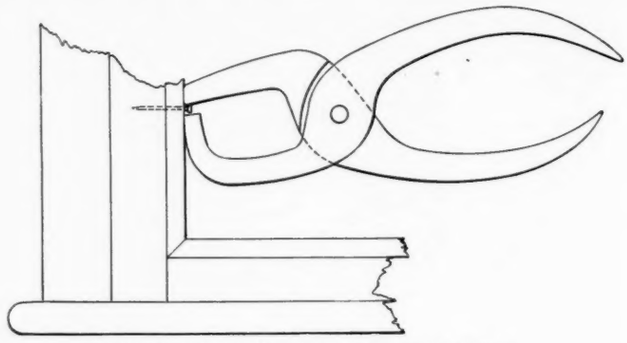


Fig. 4—Removing Brads from Molding.

the lug in this position. The nut is then removed and a block of wood about 2 in. square and 1¼ in. thick and having a ⅝-in. hole through its center, is slipped over the bolt. The nut is replaced and securely tightened. When the head is slipped over the beam the piece of wood is given one blow with an inspector's hammer, breaking it to pieces and allowing the lug to fly into the recess with a snap, locking the brake head to the brake beam.

HOW TO MAKE A TIME STUDY.

BY C. J. MORRISON.

The time study is nothing more or less than a record of the time of each motion comprising any given operation; consequently time studies are as various as are operations. Any trained observer can make a time study regardless of whether or not he understands the operation. Possibly one of the simplest time studies would be that of a man sweeping a measured section of a shop floor and might appear about as follows:

Time in hours. Running.	Time in hours. Elapsed.	Movements.
0.00	0.00	
0.10	0.10	Look for broom.
0.15	0.05	Going to assigned section.
0.45	0.30	Sweeping.
0.55	0.10	Talking to other workmen.
0.75	0.20	Sweeping.
0.95	0.20	Borrowing chew.
1.20	0.25	Sweeping.
1.45	0.25	Away from work in another section.
1.75	0.30	Sweeping.
1.90	0.15	Getting wheelbarrow.
1.95	0.05	Oiling wheelbarrow.
2.05	0.10	Taking up sweepings.
2.10	0.05	Resting.
2.30	0.20	Wheeling sweepings to dump.
Total	2.30	

Area swept, 1,800 sq. ft.

Summary.....1.55 hours useful work.
0.75 hours wasted.

Unless the man who made the time study has sufficient experience to set the standard time, his responsibility would end here and some more experienced man would set the standard for sweeping 1,800 sq. ft.

Another simple time study is that for laborers trucking material. A series of such studies in one shop showed that 1.5 hours was used for oiling each truck each day, and that empty trucks went in both directions. As in this particular shop there was practically always rough material to be trucked in one direction and finished material in the other, there was

no excuse for empty trucks, and in setting the standard time only loads were considered. What constituted a load was also defined. The result was that empty trucks became rare, one oiling a day was found to be sufficient, and, by the use of brains in loading, 1½ to 2 loads were carried each trip.

From these simple studies pass to the more complex, where considerable preliminary work is necessary. Consider the case of operations on an engine lathe. Here it is necessary to know the speed of cut and the feed for every possible combination, the rough and finished dimensions of the work, the kind of material, the tools used, and the condition of the machine. A sample time study would be something as follows:

MACHINE No. 0425.
Drawing No. 17289.—Material, Cast Steel.

Tools.	Cuts.	Speed.	Feed.
A-11	1	3	4
A-11	2	4	4
B-17	3	6	3

Time in hours. Running.	Time in hours. Elapsed.	Motions.
0.00	0.00	
0.40	0.40	Set up work.
0.90	0.50	Look for blueprint.
0.95	0.05	Set tool.
1.35	0.40	Cutting (1).
1.45	0.10	Look for calipers.
1.65	0.20	Grind tool.
1.70	0.05	Set tool.
1.72	0.02	Caliper work.
2.27	0.55	Cutting (1).
2.57	0.30	Away from machine.
2.59	0.02	Caliper work.
2.79	0.20	Grind tool.
2.84	0.05	Set tool.
3.24	0.40	Cutting (2).
3.34	0.10	Away from machine.
3.74	0.40	Cutting (2).
3.80	0.06	Change tools.
4.50	0.70	Cutting (3).
4.70	0.20	Clean up for noon.
4.90	0.20	Get out blueprint, calipers, etc.
5.00	0.10	Cutting.
5.40	0.40	Wait for helper.
5.70	0.30	Take out work and set on floor.
Total	5.70	

Summary.....3.90 hours useful work.
1.80 hours wasted.

The time study can now be placed in the hands of the trained man, who, with the aid of the data table on this machine, and the blueprint, will be able to set a standard time. After a number of time studies have been made on any given machine and these are tabulated with the actual performances, a trained man can set standard times for work on that machine without the necessity of first making a time study. One well known firm of machine tool builders has for a number of years kept records of time studies and actual performances on their machines, and now make a practice of supplying customers with standard times and operation charts for work on their machines. These times are remarkably accurate, and by following the operation charts customers all over the world have been able to attain the standards set. As an illustration; one purchaser was dissatisfied because the machine purchased took 32 minutes on a certain operation. A blueprint of the work was sent to the builder, who set a standard time of 15 minutes and furnished an operation chart to show how this time could be achieved. A little later the customer reported that the work was being done in 18 minutes, and after a few weeks announced that the average time was 14 minutes.

There is an infinite variety of time studies, but the principles are the same in all. The essential elements are a trained observer, common sense and a stop-watch. A trained observer is not of necessity a man familiar with the business. A young man taken from a stock broker's office made an observer who was able to carry a five or six time studies simultaneously. Time studies made by this man on work with which he was entirely unfamiliar were used in setting standard times that proved entirely satisfactory both to the company and the workmen. His only instructions were: "Take the stop-watch and record the time of every movement." These instructions, combined with common sense are the keynote of successful time studies.

BRAKE HANGER ANGLES.

BY R. W. BURNETT.
General Master Car Builder, Canadian Pacific.

The noticeable tendency of certain wheels to slide, in investi gating the causes of wheel sliding, led to a careful consideration of the brake hanger angle. From the results of this investigation, as well as from those of other tests, it can be shown that the standard angle of brake beam hanger recommended by the Master Car Builders' and Air Brake Associations is not the proper angle for service conditions. A moving car cannot be stopped by any force within itself, but must be stopped by a force or resistance applied from some external source. It is not the friction of the brake shoes which actually stops the car; the brakes merely make the wheels hard to turn. It is the resistance of the rail at the points of contact with the wheels which keeps them rolling against the brake shoe pressure. It is this resistance which stops the car. The truck is therefore held back by this force at the rails but is shoved ahead by the momentum of the car body. These two forces acting in opposite directions produce a transfer of load from rear to forward truck, also a tilting or upsetting tendency in the truck itself and a consequent transfer of weight from the rear to the forward pair of wheels directly proportional to these forces, the wheel base of the truck and the height of the center casting of the truck above the rail. This transfer of weight may be calculated as follows:

Let Z = The actual weights of the wheels on the rail (4-wheel truck).
N = Normal weight of a pair of wheels on the rail.
Y = Transfer of weight from the rear to the forward truck.
X = Transfer of weight from the rear to the forward pair of wheels of each truck.

$$\text{Then } Z = N \pm X \pm \frac{Y}{2}$$

Let Y = Transfer of weight from the rear to the forward truck, as above.
H = Height of center of gravity of car body above face of center casting.
B = Distance between centers of center castings.
W = Weight of car body.
P = Ratio of brake shoe pressure to weight of wheel on rail.
C = Co-efficient of friction.

$$\text{Then } Y = \frac{W \times P \times C \times H}{B}$$

Let X = Transfer of weight from the rear to the forward pair of wheels in each truck, as above.
H_1 = Height of center casting above rail.
H_2 = Height of center of gravity of truck above rail.
B_1 = Wheel base of truck.
W_1 = Weight of car body on center casting.
W_2 = Weight of truck.
P = Brake percentage or ratio.
C = Co-efficient of friction.

$$\text{Then } X = \frac{W_1 \times P \times C \times H_1}{B_1} + \frac{W_2 \times P \times C \times H_2}{B_1}$$

Example (Fig. 1):

Weight of car body	70,000 lbs.	= W
Weight of car on center casting	35,000 lbs.	= W_1
Weight of truck	15,000 lbs.	= W_2
Distance between centers of center castings	52 ft.	= B
Wheel base of truck	8 ft.	= B_1
Height of center of gravity of car body above center casting	3 ft.	= H
Height of center casting above rail	3 ft.	= H_1
Height of center of gravity of truck above rail	1½ ft.	= H_2
Ratio of brake percentage to weight	1	= P
Co-efficient of friction	.20	= C

Transfer of weight from rear to forward pair of wheels in each truck

$$= \frac{35{,}000 \times 1 \times .2 \times 3}{8} + \frac{15{,}000 \times 1 \times .2 \times 1.5}{8} = 3{,}187.5 \text{ lbs.}$$

Transfer of weight from rear to forward truck

$$= \frac{70{,}000 \times 1 \times .2 \times 3}{52} = 807 \text{ lbs.}$$

Actual weights. $25{,}000 \pm \left(3{,}187.5 \pm \frac{807}{2}\right) = 28{,}950,\ 22{,}220;\ 27{,}780,\ 21{,}410$ lbs.

Normal weights ..... = 25,000, 25,000; 25,000, 25,000 lbs.

Equalizer spring compression due to the pull of the brake beam hangers must not be considered as affecting the weight of the wheels on the rails. Whatever pull is exerted downward by a brake hanger on a truck is caused by an equal upward pull on

the wheel, and vice-versa. The pressure of the wheel on the rail is therefore unchanged. With unequal weights on the various pairs of wheels under a car during a stop, equal brake shoe pressures on all these wheels will produce unequal tendencies to wheel sliding. The rear pair of the rear truck (4-wheel) will be most likely to slide with the rear pair of the forward

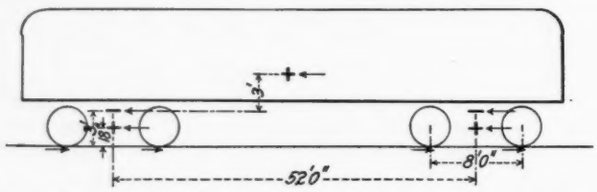


Fig. 1—Diagram of Car Considered in Calculating Transfer of Weight on Wheels Due to Braking.

truck next; the forward pair of the forward truck will be least likely to slide.

When a brake beam hanger is so hung that a line drawn through the centers of its connection pins is at right angles to a line drawn through the center of the brake shoe and wheel, the brake shoe pressure should neither be increased nor decreased by a difference in the direction of motion of the car. This is the present standard practice. If the angle formed by the hanger is greater than 90 deg. on an inside hung four-wheel truck, when the wheel is turning upwards toward the bottom of the hanger the brake shoe pressure will be increased, or when the wheel is revolving downward away from the bottom of the hanger the brake shoe pressure will be decreased. This alteration of the brake shoe pressure due to the varying angles of brake beam hangers is calculated as follows:

Let S = Shoe pressure against wheels.
W = Weight of pair of wheels on rail.
P = Ratio of brake shoe pressure to weight of wheel on rail.
C = Co-efficient of friction.
T = Tangent of angle formed by variation of hanger angle from M. C. B. standard.
Then $S = W \times P (1 \pm C T)$

Example (Fig. 2):

Weight of pair of wheels on rail..... = 25,000 lbs.
Ratio of brake shoe pressure to weight of wheel on rail..... = 1
Co-efficient of friction ..... = .2
Tangent of angle formed with M. C. B. standard (30 deg.).. = .577
Shoe pressure against wheels 25,000 × 1 (1 ± .2 × .577).. = 27,890 and 22,100 lbs.

When the brake beam hangers on an inside hung four-wheel truck are hung away from the wheels at a greater angle than 90 deg., the brake shoe pressure on the rear pair of wheels of

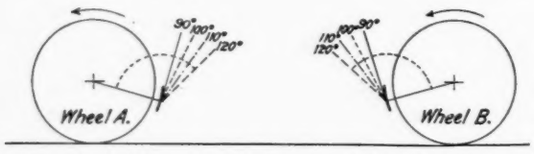


Fig. 2—Illustrating Variation of Brake Hanger Angles.

each truck will be decreased and the brake shoe pressure on the forward pair increased. But as there is a transfer of weight from the rear to the forward wheels in making the stop, if the brake hanger angle is properly proportioned, the alteration in the braking power can be made closely proportionate to the transfer of weight and the liability of wheel sliding will be considerably reduced. The transfer of weight and the alteration of the brake shoe pressure due to the angle of the hanger are alike dependent on the co-efficient of friction, and if calculated for any one co-efficient will be proportionate for all. The comparative brake shoe pressure and weights of wheels on the rail for different brake hanger angles and rates of travel are shown in Table 1. These make the effect of an alteration of the hanger angle very apparent.

The principle of varying the brake beam hanger angle to offset the transfer of weight in stopping may be applied to other types of trucks. The angle of the brake beam hanger on the center beams in six-wheel trucks should always be 90 deg. Outside hung beams on any class of truck should have the beams hung at angles of less than 90 deg. Ample allowance must be made for slack in the hangers, pedestals, boxes, etc., in addition to the wear of shoes and tires, all of which will tend to increase the angle of the hanger in service. The angle assumed should the average angle in service, that is, with the shoes, tires, etc., half worn.

The actual brake beam pressures and the increase or decrease of that pressure due to the friction between the shoe and the wheel and the angle of the brake beam hanger have been considered. This has been tabulated with the transfer of weight due to the retardation of a car in making a stop. There are many conditions which affect the pressure delivered to the brake beam, such as the height at which the brake beam is hung, the angularity of the brake beam hangers as compared to the line of pull of the brake rods, release springs, and transfers of weight in six-wheel trucks due to the pull of the hangers, angularity of brake rods and levers, etc. These should be calculated in designing the foundation brakes, and are not considered here as they have no direct bearing on the transfer of weight nor the alteration of the brake shoe pressures due to the angle of the brake beam hanger.

The principle of varying the standard brake beam hanger angle is a big departure from previous practice. It is most important on passenger equipment. While it will not be advisable to adopt angles quite as radical as the calculations indicate, the general facts outlined are worthy of careful consideration and will be borne out by the past experience of those who have had the opportunity to observe wheel sliding under various conditions of road service and brake hanger angles.

INCREASING SHOP OUTPUT.*

BY W. H. SNYDER.

Assistant General Foreman, New York, Susquehanna & Western, Stroudsburg, Pa.

An important recent addition to our equipment was the installation of a radius planer attachment on a 32-in. planer, for planing links and link blocks. Formerly we filed and straightened all links by hand. All new links and link blocks were shaped or slotted and then filed to a finish. The addition of the radius planer decreased the time required for doing this work and greatly improved the workmanship.

Piece Work.—The introduction of piece work has increased the output. The men we have working entirely on piece work are

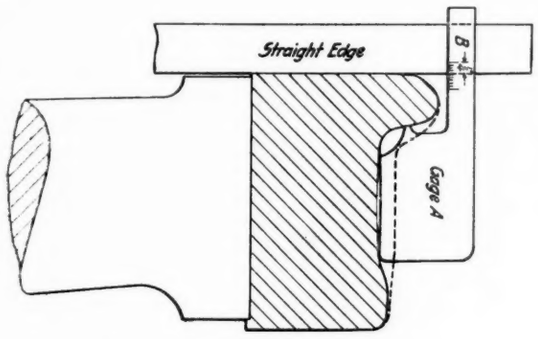
*Submitted in the competition which closed December 15, 1910.

Table 1.

Speed in miles per hour.	Co-efficient of Friction.	Hanger at 90 deg. 1st Pair.	2nd Pair.	3rd Pair.	4th Pair.	Hanger at 105 deg. 1st Pair.	2nd Pair.	3rd Pair.	4th Pair.	Hanger at 120 deg. 1st Pair.	2nd Pair.	3rd Pair.	4th Pair.	
Standing	...	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	Weight of wheel on rail.
		25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	Shoe pressure on wheel.
Up to 10 miles per hour	.2	28,590	22,220	27,780	21,410	28,590	22,220	27,780	21,410	28,590	22,220	27,780	21,410	Weight of wheel on rail.
		25,000	25,000	25,000	25,000	26,340	23,660	26,340	23,660	27,890	22,110	27,890	22,110	Shoe pressure on wheel.
From 10 to 20 miles per hour	.15	27,690	22,910	27,090	22,310	27,690	22,910	27,090	22,310	27,690	22,910	27,090	22,310	Weight of wheel on rail.
		25,000	25,000	25,000	25,000	26,000	24,000	26,000	24,000	27,170	22,830	27,170	22,830	Shoe pressure on wheel.
From 30 miles per hour upwards	.10	26,790	23,610	26,390	23,210	26,790	23,610	26,390	23,210	26,790	23,610	26,390	23,210	Weight of wheel on rail.
		25,000	25,000	25,000	25,000	25,670	24,330	25,670	24,330	26,440	23,560	26,440	23,560	Shoe pressure on wheel.

ambitious and are on the lookout for new ideas which often result in good shop devices.

Turning Driving Wheel Tires.—We have a good system for turning driving wheel tires. The operator can determine before he starts turning just how much he has to take off the tire to make a full flange. With the old system of turning tires at random the wheel lathe operator took a good big cut. When he came to finish it he often found that he could not get a standard flange and it was necessary to take another cut. Sometimes he would get the cut too deep, thereby wasting the tire. Make a gage, A, from No. 16 or 18 boiler steel. Put a line at B corresponding to the standard thickness of the flange, graduating it back about ½ in., as shown. Put a straight-edge across the inside of tire, and read the amount the flange is worn as indicated by the gage. Opposite this amount in the table the depth of cut will be found in column B and the reduction in diameter in column C. If the flange is worn ¼ in., as shown in the illustration, the depth of cut will be 7/16 in. and the reduction in diameter ⅞ in. Caliper the smallest diameter of the tire with the worn flange and close up the calipers ⅞ in., and you are ready to turn off the proper amount accurately and with no guess-work. The table can be printed on good paper with a typewriter and put in a small frame and hung up at the wheel lathe so that it may be referred to conveniently. It has given splendid results in our shop.



A. Flange Worn.	B. Depth of Cut.	C. Reducing Tire in Diam.
1/32 in.	1/16 in.	⅛ in.
1/16 in.	⅛ in.	¼ in.
3/32 in.	3/16 in.	⅜ in.
⅛ in.	¼ in.	½ in.
5/32 in.	5/16 in.	⅝ in.
3/16 in.	11/32 in.	11/16 in.
7/32 in.	⅜ in.	¾ in.
¼ in.	7/16 in.	⅞ in.
9/32 in.	½ in.	1 in.
5/16 in.	17/32 in.	1 1/16 in.
11/32 in.	9/16 in.	1⅛ in.
⅜ in.	⅝ in.	1¼ in.
13/16 in.	21/32 in.	1 5/16 in.
7/16 in.	11/16 in.	1⅜ in.
15/32 in.	¾ in.	1½ in.
½ in.	25/32 in.	1 9/16 in.

Gage and Table Used for Turning Driving Wheel Tires.

The secret of shop output is to get right after the weak points and make a special effort to help the machine or the department that is always behind. Often a slight change of equipment or of method will greatly increase the output of a certain class of work. The successful shop foreman is the one who makes a careful study of the dispositions of the men under his supervision. He must see that his men have sufficient work laid out for them, for the average man is better satisfied if he has plenty of work ahead. If he does not know what his next job is to be he will naturally hold on to the one he has and make it last as long as he can. The successful foreman must also look ahead when he knows of a certain job coming and should get all the information possible pertaining to it. If he is a machine foreman he must get busy and find out what machine the job can best be performed on so there will be no delay when the operator is ready to go on the job.

LOCOMOTIVE BUILDING IN EUROPE.

BY CAPTAIN GODFREY L. CARDEN, U. S. R. C. S.*

The past ten years have witnessed signal advances in locomotive building in Europe. This is especially true in Germany, Sweden, Belgium, France, Italy, Austria-Hungary and Russia. There was a time when American locomotives were necessary to the continental market; that time has passed. Today Europe buys from us when her own shops are unable to meet the demands. In the course of two years' inspection work abroad the writer has visited many locomotive building plants. Practice it was found differed in different countries, but without exception the standards maintained are very high. These standards are generally indicated by state railways' authorities, which in turn means government plans and government inspection.

The question of whether American locomotive works can successfully compete in Europe today rests largely on our ability to construct European designed locomotives at a profit in American shops. On all orders emanating from Europe the foreign railway authorities may be depended on to insist on their own designs and to supplement the designs with specifications of an exacting character.

The greater part of the machine work on European locomotives can be handled by American tools. At the same time there are a number of special tools in service abroad which possess merit. The latter machines are of foreign origin and appear to have been built especially for the locomotive trade.

BORSIG WORKS, GERMANY.

The Borsig Works at Tegel on the outskirts of Berlin employs about 5,300 men, and is one of the best all-round machinery works in Germany. Borsig is turning out 300 locomotives per year; the greatest number built in any one year was approximately 350. It is doubtful if any other works except those at Cassel, Germany, are exceeding this output. Few of the European locomotive works find it possible to devote their entire attention to locomotive building, in other words, to specialize. The Borsig shops, for example, are engaged in building hydraulic presses, steam engines, ice machines, boilers, compressors and locomotives, and yet the tendency at Borsig's is to specialize, for not long ago, it dropped the building of gas engines. However, there was no work in hand more important than the locomotive orders. The Borsig shops are building for Russia, Sweden, Chile, Argentina and the far East. For Argentina, American type locomotives are furnished. By that I mean, the general type of the locomotive is American.

Practically all the locomotives built at Borsig's are of the plate-frame type of construction. These plates are cut out by oxygen-gas tools, the work being done quickly and in a most economical manner. The oxygen-gas tools are obtained in Berlin. At the Breslau shops in Germany hydraulic presses stamp out the plates. The general practice, however, in the German shops is to punch out the plate frames and to finish off with special types of milling machines. Chemnitz and Offenbach machine tool makers are offering special lines of milling machines for this plate frame work. The opinion was expressed by a director of one of the foreign locomotive shops that there did not appear to be available a good American line of heavy vertical millers.

At the Borsig shops and elsewhere in Germany copper fireboxes and copper stay bolts are the rule. These are specified by the Prussian State Railways' authorities.

Building French Locomotives at Borsig's.—At the time of the writer's visit, Borsig was building French locomotives for 1 mark 10 pfennigs (26.2 cents) per kilo (2.2 pounds). Borsig officials declared that they were losing money at this rate. At

*Captain Carden was detailed for two years in Europe as special agent for the Department of Commerce and Labor. His duties required him to report on the general machinery situation, especially with reference to machine tools. During this service he visited several hundred plants. The reports covering these visits are on file in the Bureau of Manufactures at Washington.

the same time they were advised that an order for French locomotives had been taken by the American Locomotive Works at a rate which amounted to 85 pfennigs (20.2 cents) per kilo. It is since understood that the American Locomotive Works was only inconvenienced in respect to receiving essential elements from abroad which the designs specified should be incorporated in the locomotives.

Wages.—At the Borsig works good tool men are expected to make at least 85 pfennigs (20.2 cents) per hour. Two workmen picked out at random were questioned by the shop manager for my benefit as to wages they were earning. One man received five marks ($1.19) per day on an eight hour basis, while the second said he was making about seven marks ($1.66) per day. The manager declared that the first man was not earning as much as the shop permitted. In other words, it is possible to earn seven marks per day if a man puts forth the effort.

Fireless Locomotives.—Fireless locomotives form an important part of the construction work at Borsig. So far as the writer knows this type of engine is practically unknown in America. The fireless locomotives use superheated water and when leaving a charging station the pressure is 170 lbs. At the Borsig Works one of these fireless locomotives was in almost constant service throughout the day and I was informed that it was only necessary to connect up twice during the working hours with the boilers of the power plant—in the morning before work commenced and again during the noon hour. Connection was made with the plant to the front end of the locomotive through flexible pipe and about fifteen minutes sufficed to charge. These are in much demand in Scandinavian logging camps and are especially recommended where insurance might be prejudiced through the use of electric or fuel-fired engines. It was found in practice that even at pressures of one to two atmospheres considerable work could be accomplished and at a pressure of one-quarter to one-half an atmosphere the engine was still able to go to the filling tank. The Borsig engine which I had occasion to examine while in service seldom required to be filled oftener than once in four hours.

HANOVER LOCOMOTIVE WORKS.

The Hanover Locomotive shops employ about 3,300 men. These works have built more than 5,000 locomotives, and their latest type of high-speed passenger engine is specially well spoken of. It is known as the Atlantic type and resembles closely the American locomotive of the same class. In this type one observes the bar-frame construction, but generally speaking the plate frame form is adhered to. The Hanover shops apparently build as many bar frame engines as they do plate frame, while Borsig's build more plate than bar. Borsig, however, supplies bar frames when his customers prefer them, but says that he has not found it necessary to provide special tools for the purpose of making bar-frames, which would indicate that plate-frames can be made with the same tool equipment as bar-frames.

The Hanover shops are sending about 30 per cent. of their locomotive output abroad. To the year 1907, when locomotive No. 4800 was completed, 22 per cent. of this company's output was for foreign countries.

Lentz Poppet-Valve Gear.—For all high-speed engines for the Prussian State Railways the poppet valve gear of the Lentz type* is used. I was assured by the Hanover Works that there was a saving of not less than 20 to 25 per cent. when a comparison is made between the poppet valve gear using superheated steam and slide-valves operating with saturated steam. One high-speed locomotive of the Prussian State Railway had already run 60,000 miles using this type of valve gear. Twenty-three engines of the International Works at Vienna had this type of gear installed on all the high pressure cylinders and in one year's time the entire cost of the change was saved in coal consumption. The management of the power plant of the Leipsic Street Car Railways not long ago, it was stated, converted four steam engines and equipped five boilers with superheaters; as a result of the utilization of the poppet valve gear with superheated steam 48,356 marks (about $12,000) was saved per year.

The Hanover shops are using the Pielock type of superheater with the Lentz poppet valve gear. It was stated that the introduction of this type of poppet valve was brought about largely because of the obstacles arising from using superheated steam. The Prussian State Railways are not using superheaters with compound arrangements. This is, however, at variance with the views of the engineers at the Hanover shops. From what I can learn, the success of the poppet valve gear has proved so great from an economical standpoint that it is now quite common for locomotives in service to be altered and provided both with superheaters and poppet valve gears. The change necessitates a new cylinder, as well as valve chest, since the poppet valve box and cylinder are cast in one piece.

Wages.—At the Hanover shops expert men at the machine tools receive on an average 70 pfennigs (16.6 cents) per hour, which is about 15 pfennigs (3½ cents) less than the men at Borsig's are paid. The Hanover shops own about 150 houses, which are rented at an average of 15 marks ($3.57) per month. The income is sufficient to keep up repairs, and no attempt is made to derive a profit.

OTHER GERMAN LOCOMOTIVE WORKS.

The Hohenzollern A. G. Locomotive Works are located near Düsseldorf and employ about 1,400 men. The plant is turning out about 140 locomotives a year. These shops employ plate-frame construction almost exclusively, and all plates are cut out by punching machines. Pielock and Schmidt superheaters are used, but I could not learn of any special valve gear being employed. This firm is building for Scandinavia and Indian railways.

Still other locomotive shops in Germany are those at Cassel, Breslau, Altoona and Munich. The Schwartzkopff shops are not far from Berlin and the general practice there resembles closely that at Borsig's.

Wages.—At the Hohenzollern Works expert tool men receive about 70 pfennigs (16.6 cents) per hour. The rate paid in the Berlin territory is higher than elsewhere in Germany. The lowest rate paid is in the Chemnitz district, where expert machine men seldom receive over 50 pfennigs (11.9 cents) per hour. The rates in the Rhine territory and in the Hanover district are about equal, namely 70 pfennigs (16.6 cents) per hour for good machine tool men.

LOCOMOTIVE DEVELOPMENT IN GERMANY.

During the past five years locomotive development in Germany has tended toward higher speeds and greater economy. The general increase in the size and power of locomotives is due to continental traffic conditions. Superheaters appear to be coming more and more into use. On the Prussian State Railways the authorities have limited the maximum steam pressures to 170 lbs. In Saxony and Bavaria four-cylinder compound locomotives are much in vogue, and some of the lines have been experimenting with this system in connection with superheaters. Balanced compounds are much liked abroad, due to ability to construct a stronger engine frame.

There has been little change in the matter of finish and form on the continent for a number of years, and the opinion is general that the standards exacted are onerous. The German locomotive builders found the recent French contracts especially hard. Many of the parts were required to be case hardened and the designs called for slide-valves of a particular kind of bronze. The standard metal which could be supplied readily and easily, and which the experience of years had indicated was excellent, would not suffice. It was almost a universal comment in Germany that the French when they prepared their designs

*The Lentz poppet valve gear has four valves; two on the inside for admission, and two on the outside for exhaust. They are actuated by a cam rod and are weighted by springs. They have given good service at high speeds, working safely and exactly at three hundred revolutions per minute.

had plenty of money to spend. Where a standard German design would require only one slide bar, the French, it was pointed out, had managed to incorporate four slide bars. I asked one German director if his firm expected to make much money on these contracts. His reply was: "We shall at least gain considerable experience and shall know what to expect when we take a second contract." There is no question that the finish and form demanded abroad is expensive, but the trade apparently demands it.

It was my practice whenever opportunity presented to chat with the engineers of the high-speed locomotives of the Prussian railways. These men are for the most part clever and intelligent, and exhibit a certain self-reliance which may be expected of men in their calling. They invariably praised the poppet valve gear and declared that it gave no trouble and where used with superheated steam, was a great saver of coal. The Prussian engineers regard briquettes as poor fuel for high-speed locomotives, declaring that they pack too hard on the fires and do not permit of the spread which can be obtained with loose coal. The Metcalf feed-water heater seems to be in general service throughout Germany. The Hanover shops, however, are developing a new type of feed-water heater, from which much is expected.

In counter-distinction to the German practice, the Belgians seem to favor non-compound engines with superheaters, and this form of engine is common in the express locomotive service. For freight engines the Belgians are utilizing the two-cylinder non-compound engines with superheaters.

Germany is exporting approximately 400 locomotives per year. In 1907, for example, Germany exported 395 locomotives. This number was absorbed by Belgium, France, Italy, Russia-in-Europe, Turkey-in-Asia, Southwest Africa, Prussia, Egypt, India, East Indies, Argentina and Chile. For 1907, France took 555,500 lbs.; Italy, 504,460 lbs.; Egypt, 594,600 lbs.; Chile, 449,460 lbs., and Argentina, 446,160 lbs. Egypt took more than any other country, followed in order by France, Italy, Chile, Argentina and Russia-in-Europe.

FRANCE.

At Le Creusôt in France, Schneider & Company are building some of the best engines of French design. This firm is to France what Krupp is to Germany, that is to say, Le Creusôt is the great ordnance establishment of France. In addition to building guns these works also construct both marine and stationary engines, railway equipment and locomotives. The shops at Belfort will turn out more locomotives in a year doubtless than Le Creusôt, but for high grade work, there is nothing finer in France than is produced by Schneider & Co.

SWITZERLAND.

The Swiss Locomotive Works at Winterthur employ about 1,800 men. This is one of the best locomotive shops in Europe. Its engines are sent to all parts of the world, and it is doubtful if there is a higher finish to be found on any European locomotive. This firm is about to undertake bar frame construction, and at the time of my visit the first set of bar frames had just been received. These frames were of forged steel and were received from Germany. Among the engineers in charge of departments was one gentleman who saw service in the Baldwin Locomotive Works for several months and whose observations on the general locomotive situation were among the best I have heard in Europe. In fact, those engineers whom I met at the Swiss Locomotive Works impressed me as being of very high order. A large number of American machine tools were in use in the Winterthur shops. I also observed a number of the heavier types of English tools. English tools ten years ago formed the major complement of most of the continental locomotive works, but in recent years few English tools are going into these shops. When new tools are obtained, they are almost invariably of German or American origin. There are a few English tools which are offering sharp competition to American machines. I refer particularly to Herbert of Coventry; Smith & Coventry of Manchester, Darling & Sellers of Keigley; Kendall & Gent of Manchester, and Richards of Broadheath.

The three-cylinder compound engine has not been tried to any great extent on the continent, although the Jura-Simplon Railway, which is now the Swiss Federal Railway, has several mogul engines of the three-cylinder compound type at work. This same railway has mogul engines of the four-cylinder compound type. The special three-cylinder compound type of engine which was in use in the United Kingdom for a number of years has now entirely disappeared. So far as could be learned superheaters have not been applied abroad to Mallet locomotives.

ITALY.

At the Breda Locomotive Works in Milan the force employed numbers approximately 4,500; of this number about 2,000 are engaged in the locomotive department in Cittá. Breda is turning out a new high-speed locomotive, designed for a speed of 120 kilometers (74.5 miles) per hour. It is a beautiful four-cylinder machine working compound and operating four cranks. The compounding is independent for each side. Superheat is not used. About 40 of these engines have been turned out for the Italian State Railways. Krupp and Bochum furnish practically all the wheels and axles used. As elsewhere in Europe, copper fireboxes and copper stay bolts are the rule. Here, as in German shops, one is impressed with the great amount of unnecessary work. In the finishing shops no less than 12 applications of paint and varnish follow filling. All this filling, varnishing and painting, that is to say the exact number of applications, are fully prescribed by the state engineers in the specifications.

Breda bores all six cylinders on the new passenger locomotives simultaneously. He makes his own boring tools and turns out a gang of horizontal borers designed, as above stated, to take the two high-pressure and two low-pressure cylinders and piston-valve chamber simultaneously. All the plate-frames at Breda's are worked with triple slotting machines. I observed no oxygen-gas cutters or hydraulic presses in use for stamping out frame parts. I saw but very few German tools in these works. The foundry is turning out especially fine cylinder combinations, readily made and in one casting. Only plate frame form of construction is used and the steel comes both from Germany and Italy. The Breda firm is representative of modern and progressive Italy. Workmen receive about 40 centimes (7¾ cents) per hour on an average throughout the year, ten hours comprising the working day. The men are working fast, and there is a care and attention bestowed on the locomotive work in keeping, almost, with some of the best work I have seen in automobile shops. No superheaters are used. Breda builds almost entirely for Italy, as the firm finds it difficult to compete abroad with the Germans. A few locomotives, however, have been built for Denmark and Roumania. The new engines for the Italian State Railways are using the highest steam pressures on the continent, 235 lbs.

The first cog-wheel railway of the Abt system in Germany was opened in the Harz mountains 25 years ago. This anniversary is called to mind by a list of the principal railways, or parts of railways, of that system now existing. There are 55 such lines, with an aggregate length of 288 miles, on which the cog-wheel is used; the engines are made to run by friction where the lines are level enough. There are 7 in South America, 1 in Australia, 1 in Japan and 2 in India. The only one in this country is the line up Pike's Peak, which reaches a greater elevation than any other. There are 317 Abt locomotives on these lines, the smallest weighing but 5,400 lbs., while on the Transandine railway is one weighing 92 tons. The inventor, Roman Abt, still lives in Lucerne, Switzerland, and has held important positions on the Swiss railways.

PICKED UP ON THE ROAD.

BY GULF.

I was talking with the manager of a large machine tool works the other day, and he was half deploring, half wondering at the reason why, in all of his experience, no graduate of a technical school had ever developed into a first-class designer, whereas a number of just plain boys, out of the high school, who wanted to work at mechanics had evolved into brilliant successes. His solution was that it was not because boys with a natural aptitude for the work did not go to technical schools, but because when they did go they were so imbued with ideas of their own high value that they failed to realize the fictitiousness of that value until they had been ripened by experience and so had not the patience to continue their preliminary training in the hard school of shop routine at ten dollars a week until they were worth more.

It may as well be said of the engineer and designer, as of the poet, that he is born not made, for there is something that must be inate in the heart and soul and mind of a man that enables him to instinctively detect the eternal fitness of things and so blend the hard calculations of the pencil with experience and what seems right, that the product shall be not only a mechanical but a commercial possibility. It is this lack of mechanical instinct that bars many a trained engineer from being a success as a designer; just as it is the failure to appreciate the commercial necessities of a problem that has prevented hundreds of natural born mechanics and prolific inventors from being little more than a charge on the public and their friends. It certainly is not all training that makes a successful engineer, but that peculiar combination of adaptability, which, in one form or another, makes for success in every walk in life.

From this talk and the criticism of the various aspects of technical education that we see and hear, I am led to fear, though I hope my fear is unfounded, that the faculties, individually and collectively, are open to the same criticism that I offered years ago regarding similar bodies of academic colleges. This was to the effect, that they utterly disregarded the teaching of experience, or rather barred experience from any entrance or effect on their own life and teachings. When a sensible builder of steam engines sends out a sample of his wares, he follows it up and learns of its performance, and so changes his later designs that he overcomes the difficulties and defects that were found to exist in the earlier ones. The academic professors never did anything of the sort. They taught Latin and they taught Greek in the same way for fifty years; and they taught Latin and Greek utterly regardless and oblivious of the good or ill effects that it might have on their pupils or victims. They never knew and seemingly never cared whether Latin and Greek were universal panaceas for all mental weaknesses, or whether their students left them only to curse them for their stupid bigotry that could not see that every boy did not want the same mental dose any more than every sick man needs a dose of the same physic. In short they did not know the value or lack of value of their own teachings. Their universal advice to rich and poor, brilliant and stupid, linguist and mathematician, was to come to us and be filled or stupified, according to its effects, by the dope we have to offer. Is it possible, then, that the teachers in the technical schools are falling into the same pit? Do they never see that it will be as impossible to make engineers out of some boys as it is to make the mythical silk purse from ear of a sow? Do they ever take such a boy aside and try to indicate the path he should follow, even though it may be depart from their own specialty? If they do not; are they not at fault? Are they not disregarding what experience should have taught? Are they not showing that it is fair to presume that they are ignorant of the value of their own teachings? Fortunately many of them have awakened, or are awakening to their responsibilities and the possibilities of good that it is in their power to accomplish. The imperative need is for more men of the type of Prof. Herman Schneider, of Cincinnati, who has done such splendid work in introducing the co-operative courses in the engineering department at the University of Cincinnati and of introducing the continuation school (*Railway Age Gazette,* May 6, 1910, page 1171 and January 6, 1911, page 27) in connection with the public school system.

PIECE WORK NOTES.

BY HARRIE R. HAMER.

Piece Work and Shop Methods Office, Canadian Pacific, Angus Shops, Montreal, Can.

The workman must be in charge of a machine that will do his ability proper credit. The foreman must see that the machinist does not have to look for work, and must find it for him. The men should not have to hunt for bolts or tools with which to clamp a job in position. Bolts and nuts used for clamping purposes, especially for repetition work, should be placed in charge of a tool man, whose duty it is to replace any that require repairing. I have seen men waste from 10 to 15 minutes looking for a couple of bolts. I have seen them pick up a bolt with a damaged thread, and if it was the required length, go to the tool stores for a set of dies, and run over the thread, using another man's vise while doing so, thus keeping the vise-hand from working, as well as leaving their own machines at a standstill. Even with an apprentice, this sort of thing should not be tolerated. Can an expensive machine pay its owner by standing idle for 10 or 15 minutes, at intervals? Emphatically, No!

If a machine is not good, then it obviously cannot give good results, and it will pay the owner to instal a good one. Penny wise and pound foolish is an old adage the results of which I have observed in many shops.

Apprentices should understand from the outset that the employer's interests are also their own. They should learn to read a working drawing correctly and readily, and if they take an interest in their work let them have plenty of scope in which to prove their ability. Boys should not be kept on one machine for 12 months, as I have seen done, but should be moved about, thereby not only interesting them in their work, but also making them of some account on the productive force.

Demonstrators are a great factor in the success of the system and must be interested in their work. They must be capable of actually demonstrating to the men in the shop what is to be done and the best method of doing it. A demonstrator is placed in the shop to demonstrate shop methods—not as an ornament. He must possess tact and initiative. A demonstrator who would rather sit in the office than be in the shop, cannot possibly be interested in his work, therefore, the best results are not to be expected. To be effective he must be a man of action.

Another factor which materially affects a piece work system is the question of belting. How often is a machinist, whose machine is belt driven, to be seen standing idle (not only the man, but the machine) whilst waiting for a broken belt to be repaired. The matter of belting, therefore, calls for a good belt upkeep and repair system. I have noticed with interest the rapid progress in this direction which the Tabor Manufacturing Co. has made.

A successful piece work system thus depends on several factors, which are not always given the attention they deserve. These details must receive proper consideration or the system will not be a thorough success.

During the past 30 years the total mileage of electric railways in the United Kingdom has increased from about 300 to 2,562 miles. The capital expenditure has increased from $20,475,068 to $359,837,083, the number of passengers carried from 146,000,000 to 2,743,000,000, and the net receipts from $1,123,947 to $24,068,672.

Shop Kinks.

Five of the eighteen collections of shop kinks, which were submitted in the competition which closed January 15, are reproduced on the following pages. The first and second prize articles and one other were published in the issue of February 3.

ELIZABETHPORT SHOPS; CENTRAL RAILROAD OF NEW JERSEY.

BY FRANK J. BORER.

Foreman, Air Brake Department, Elizabethport, N. J.

Credit also due to William Alter, General Foreman Car Department.

SAND BLAST MACHINE.

A sand blast machine, mounted on a low four-wheel truck not shown on the drawing, is illustrated in Fig. 43. This machine has been in use for two years and has sand blasted about 1,600 steel coal cars and 100 engine tenders. Two laborers can

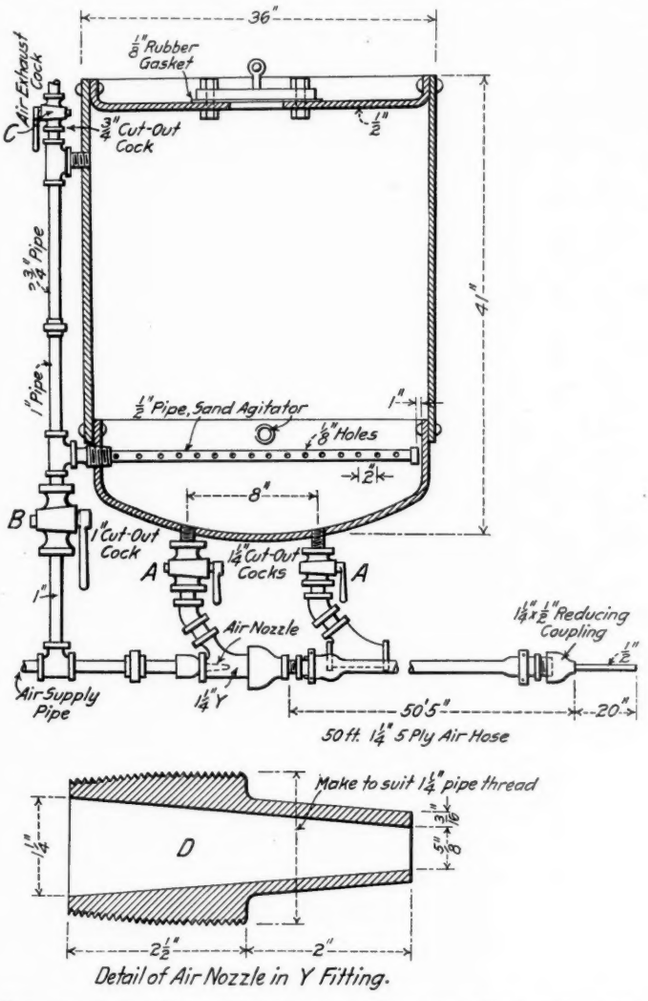


Fig. 43—Sand Blast Machine for Cleaning Steel Cars and Locomotive Tenders.

sand blast a steel car complete in less than half an hour. The machine is operated by compressed air at from 80 to 90 lbs. pressure. The 1¼-in. cut-out cocks A regulate the flow of sand from the machine. The cock B is always open while the machine is in operation. The ¾-in. cut-out cock C releases the air pressure from the tank when the work of sand blasting is discontinued, or when it is desired to refill the tank with sand. In order to agitate the sand so that it will flow freely into the two outlet pipes, air is forced into the tank through the two ½-in. pipes near the bottom, which have ⅛-in. holes drilled in them. Unless this provision is made all of the sand will not flow out of the tank, particularly if it is at all damp. Air also enters the tank through the ¾-in. T just below the cock C. It also flows through the nozzle D in the 1¼ in. Y and joins the flow of sand from the tank, thus forming a partial vacuum in the Y fittings, causing the sand to flow uniformly in the proper quantity, and at a velocity that will give the most efficient results. Hard crystal ore sand gives the best results, although any sharp sand of medium fineness may be used. We have used the same sand several times, but find that it does not cut well after the third time. After it is useless for air blast purposes, it may still be used to advantage on locomotives. The screen shown in Fig. 44 is used when it is desired to use the sand a second or third time. It will pass through the screen and funnel into the tank as fast as two men can shovel it.

The track used for this work should be so arranged that the cars or engine tenders to be sand blasted will run to and from the sand blast machine by gravity, thus making the use of a special engine to shift the cars unnecessary, or doing away with the slow method of pushing the cars with pinch bars. In order that no time may be lost in refilling the tank of the sand blast machine, an old box car has been rebuilt and is used as a sand storage car. It is filled with sand at the sand house by means of two drop doors in the roof of the car. Two

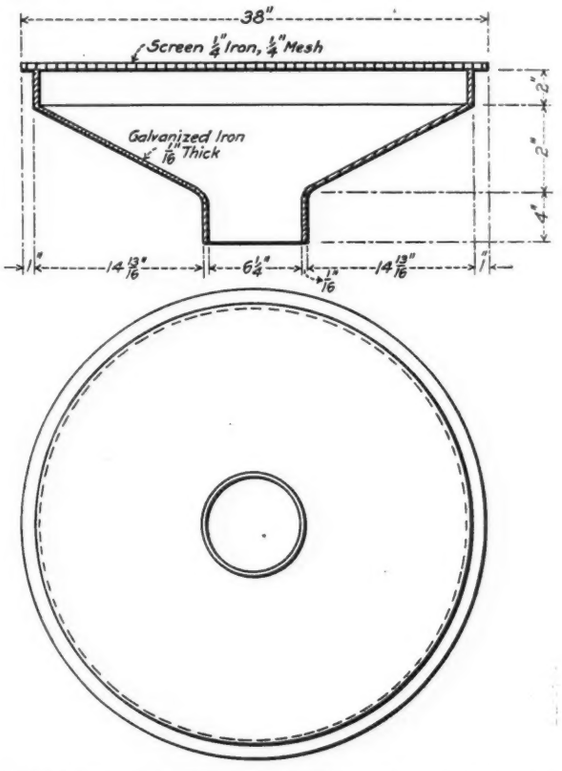


Fig. 44—Screen and Funnel for Filling Tank of Sand Blast Machine.

pockets or hoppers are provided in the car, each holding about 10 tons of sand. Two small sliding doors are placed on one side of the car, through which the sand may be run directly into the tank of the sand blast machine. To open or close the inlet to the tank, it is necessary to remove or replace six 1-in. nuts and the cover plate. As there are two separate sets of air inlet and air and sand outlet pipes, which are independent of each other, two men may sand blast different parts of the car at the same time, which is an important advantage.

Before the sand blast was used for removing the rust and old paint from cars and tenders, we used steel brushes, scrapers, revolving steel brushes operated by air motors, and other devices, but with very little success. They do the work only half as well and require twice the time. The most important places to be scraped and cleaned, which are around the rivet heads and at the angles and joints, could not be cleaned at all, or not very well, with these devices. The sand blast machine is simple to operate and cleans the steel around the rivet heads and in the joints and corners thoroughly. Two men can sand blast a car at the same time, one working on each side. Because of the agitator in the tank, damp or partly wet sand will not interfere with the working of the apparatus. The supply of sand to the hose is uniform and there is no waste of either sand or air. The machine is also used to advantage for sand blasting the brass trimmings from passenger cars, these parts thus being given the appearance of statuary bronze or old gold.

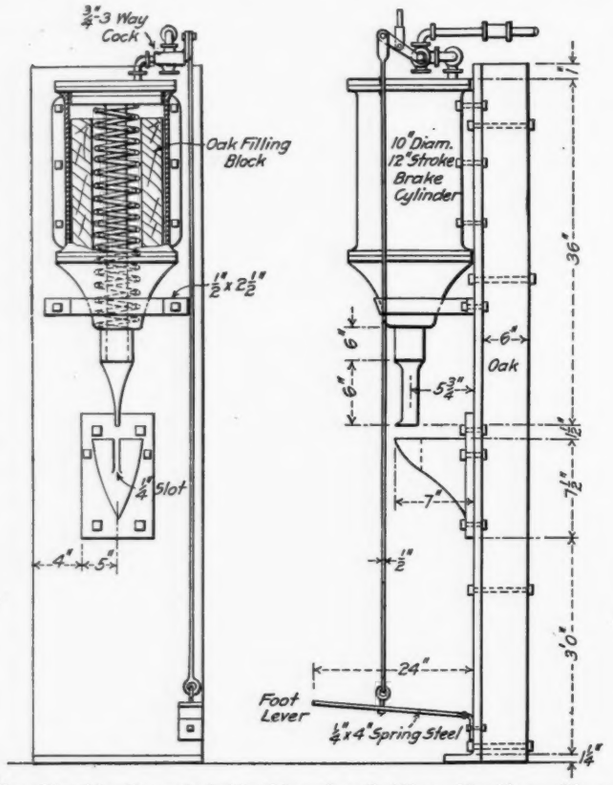


Fig. 45—Air Operated Machine for Cutting Air Hose Clamp Bolts.

STRIPPING AIR HOSE.

The apparatus for stripping the fittings from air brake and steam hose shown in Figs. 45 and 46 has caused a saving in time of from 60 to 70 per cent., and a saving in air hose clamps of from 20 to 30 per cent., as compared with the methods formerly used. By means of the air hose clamp bolt cutting machine shown in Fig. 45, and the stripping machine shown in Fig. 46, an ordinary laborer can cut the bolts and remove and assort all the fittings for 100 air brake hose per hour, and this without injury to the fittings. We have stripped about 45,000 air brake and air signal hose and 2,000 steam hose with this apparatus, which was constructed about a year ago. The bolts which hold the clamps are first cut on the machine which is illustrated in detail in Fig. 45. It consists of an old 10-in. passenger car brake cylinder fitted with a plain head. Air is admitted to

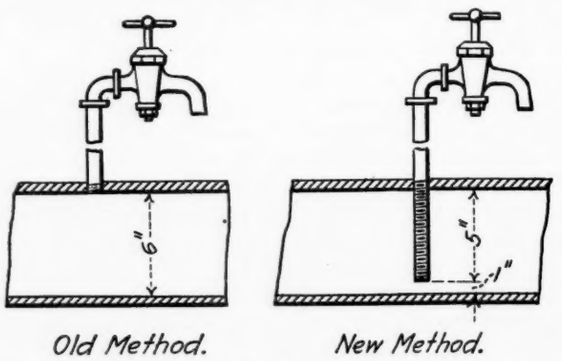


Fig. 47—Improving the Water Supply to the Shop Faucets.

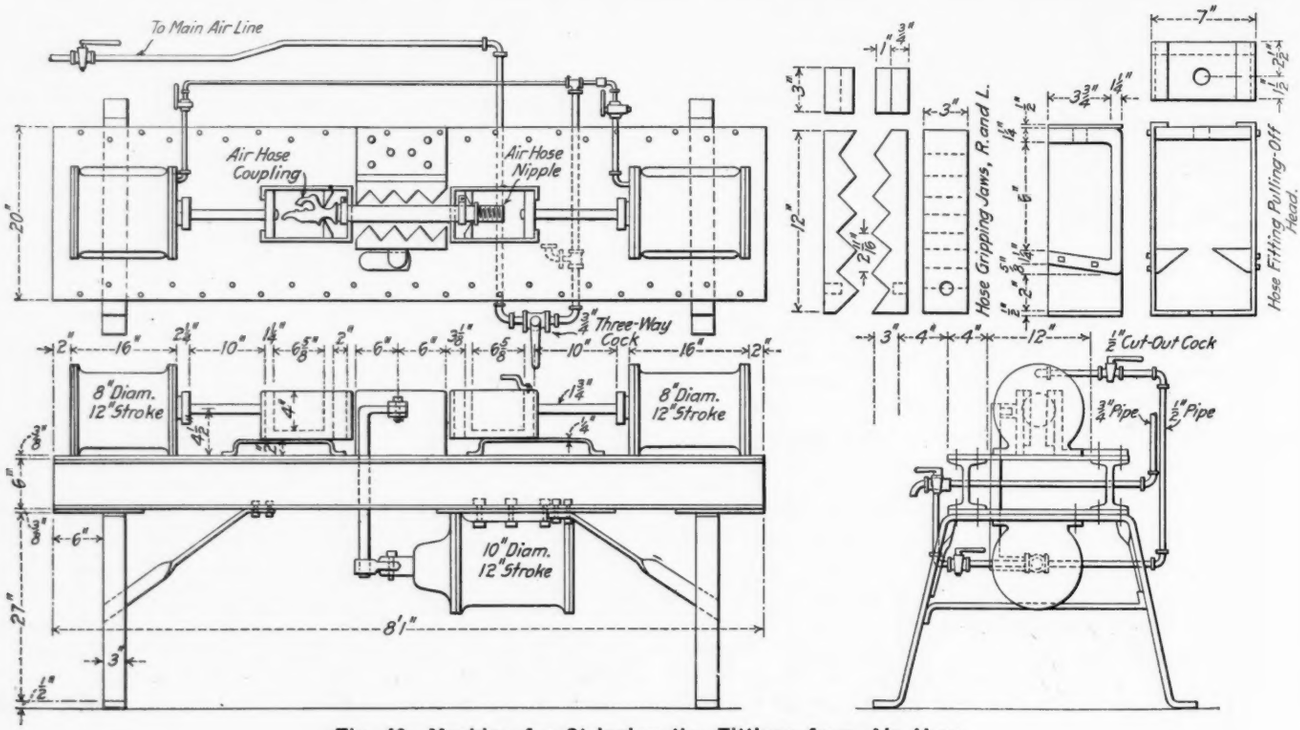


Fig. 46—Machine for Stripping the Fittings from Air Hose.

the upper end of the cylinder through the ¾-in. three-way cock, to the handle of which a coiled spring is attached from above. The spring, which is not shown in the drawing, automatically returns the three-way cock to the release position as soon as pressure is removed from the foot lever. The standard brake cylinder piston release spring returns the piston to its upper position after each stroke. The stroke is limited to 2 in. by the oak filling block which is 9¾ in. in diameter and 10 in. long, with a 6-in. hole through the center for the piston rod and the release spring. The frame which supports the device consists of two old 1¼-in. by 5 in. arch bars, which are backed up by two pieces of oak, 6 in. square. The upper part or shank of the chisel which cuts the bolts fits over the end of the piston rod and is held in position by a ⅝-in. set screw which is not shown.

After the clamp bolts have been cut, the hose is placed in the stripping machine, shown in Fig. 46. By operating the three-way cock air is admitted to all three of the air cylinders at the same time. The forked end of the piston rod of the air cylinder underneath the table is connected to a lever which operates the clamps that grasp the hose firmly near its center. At

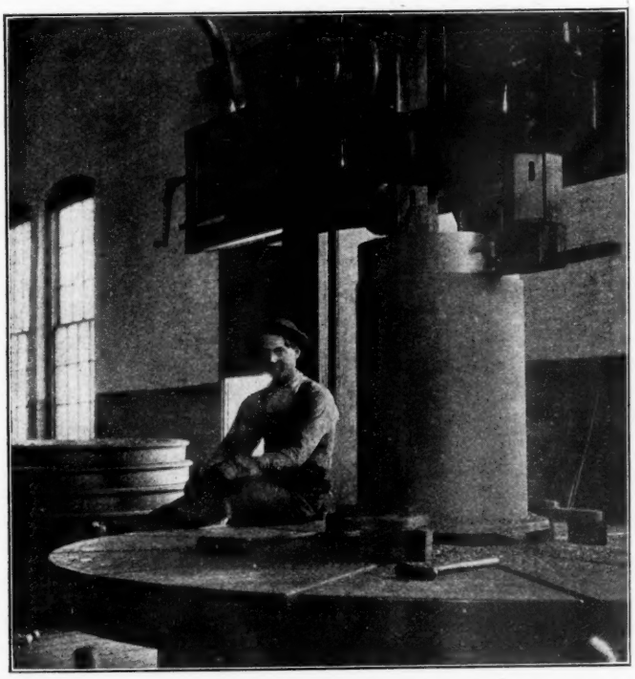


Fig. 48—Turning and Boring a Cylinder Bushing in One Operation.

the same time the pistons of the two cylinders at either end of the top of the table move outward, pulling off the air hose coupling, nipple and clamps. The three-way cock is then placed in the release position and the pistons of all three cylinders are forced to their normal positions by means of the ordinary brake cylinder piston release springs. A filling block 4 in. thick has been placed in each of the two top cylinders to shorten the stroke; the blocks are cut out at the center to make room for the piston and release springs. The two top cylinders are old 8-in. freight car brake cylinders and have been fitted with plain heads on both ends, one head being fitted with a packing nut and stud to allow the 1¾-in. piston rod to pass through it. The outer end of the piston rod is threaded for a distance of 2 in. to take the heads which fit over the hose coupling and nipple.

WATER SUPPLY TO SHOP FAUCETS.

We had considerable trouble with the water supply from the main water pipe to the ½-in. faucets in the shops. This was due to the fact that the main water pipe runs parallel and close to the main steam pipe, and also because the water main was tapped at the top. After opening the faucets we would obtain dirty and greasy water. The method of taking the supply from the main water pipe was changed, as shown in the accompanying sketch, Fig. 47, thus overcoming the difficulty.

WAYCROSS SHOPS; ATLANTIC COAST LINE.

BY R. E. BROWN.

Machine Foreman, Waycross, Ga.

BORING AND TURNING CYLINDER BUSHINGS.

A method of boring and turning cylinder bushings at one operation on a vertical boring mill is shown in Figs. 48 and 49. The rough bushing is made 4 in. longer than the cylinder, with a flange at one end for clamping. After clamping it to the

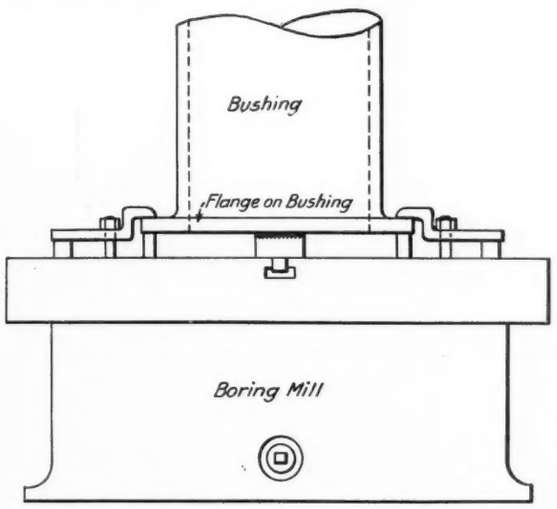


Fig. 49—Cylinder Bushing Clamped to Boring Mill Table.

table one head of the boring mill may be used for turning and the other for boring. This requires about one-half the time of the old method and eliminates any liability of the bushing being sprung out of round.

FINISHING TRUCK WHEEL CENTERS ON A BORING MILL.

Blocks for holding the truck wheel centers on a boring mill table are shown in Fig. 50. Four of these are fastened to the

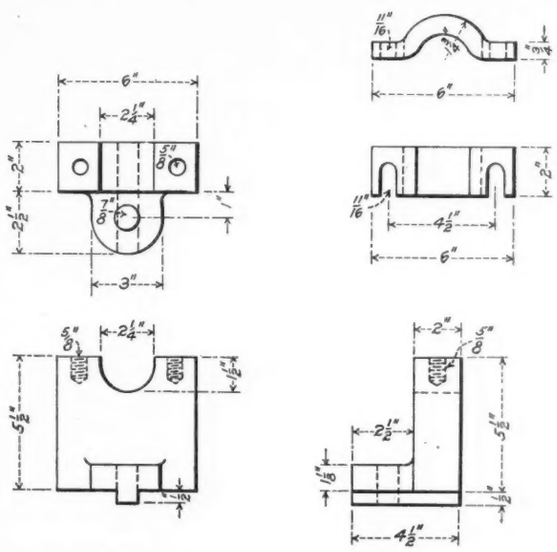


Fig. 50—Blocks for Centering and Clamping Truck Wheel Centers on a Boring Mill.

table by bolts through the flanges and are set in a circle 90 deg. apart. The tongues on the bottom of the blocks fit in the slots in the boring mill table. The wheel is dropped on the

blocks, the spokes resting in the depressions, and is clamped to them by adjustable clamps which fit over the spokes. The wheel requires no further setting, as the blocks in which the spokes fit bring it central. Our wheels have eight spokes. For wheels having an odd number of spokes, or a number not a multiple of four, the block could be bolted in the proper position on a plate which could in turn be secured to the boring mill table.

MACHINING THE OUTSIDE OF SOLID ROD CUPS.

A device for machining the outside of solid rod cups, rocker arm bosses, etc., on a drill press, is shown in Fig. 51. The

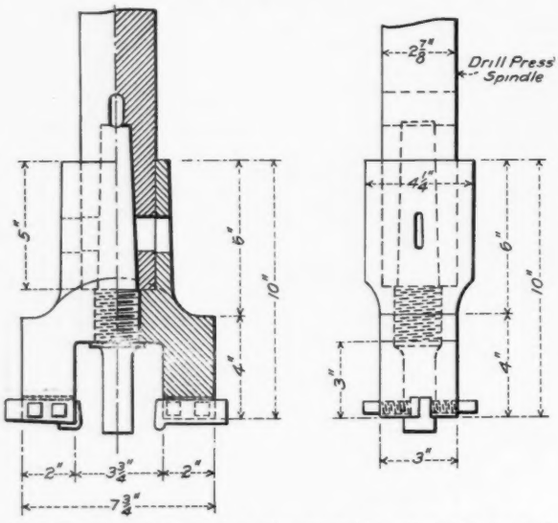


Fig. 51—Tool for Machining the Outside of Solid Rod Cups.

sleeve at the upper end fits over the drill press spindle and is held in place by a flat taper key. The forked end is milled at the ends of the two forks to take ½ in. by 1½ in. tools which are secured by set screws as shown. One of the tools is made

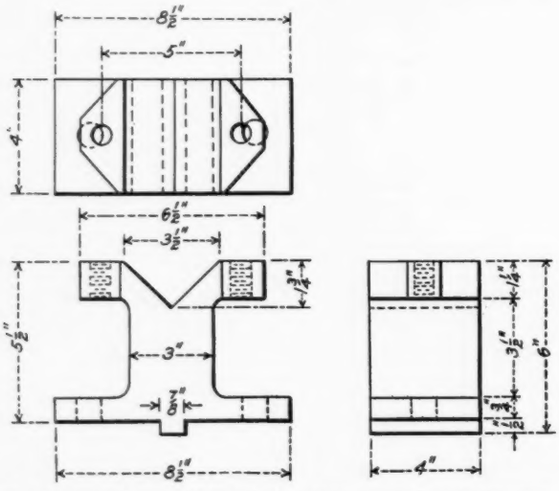


Fig. 53—Ordinary V-Block for Use on a Crank Planer.

with a straight face for finishing the rod at the bottom of the cup, and the other is rounded for the finishing cut and filleting. The tool with the straight face at the bottom is set a little in advance of the other tool and takes a roughing cut on the side of the cup as it is fed down, the other tool following it with a finishing cut. Cups may be finished on the outside in fifteen minutes with this tool. A pin may be placed in the center of the tool, which will act as a guide and furnish stability during the operation. Different sizes of these pins may be used for different classes of work; in turning a cup or boss a hole is first drilled for the insertion of the pin. The tool may be used with or without the pin, as the nature of the work requires.

V-BLOCKS FOR PLANING CROSSHEADS ON A CRANK PLANER.

V-blocks used for supporting and clamping the piston rod when planing crossheads on a quick return stroke crank planer are shown in detail in Figs. 52, 53 and 54. They are of simple design, one being an ordinary V-block and the other having an overhang of some 10 in. to provide a more rigid support. Any

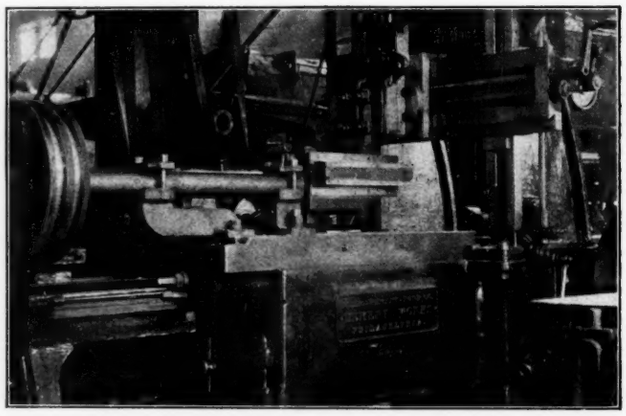


Fig. 52—V-Blocks for Supporting and Clamping the Piston Rod When Planing Crossheads.

style of crosshead may be used with them, and as the crank planer is much quicker in movement than other types of machines, it is evident that much time may be saved. These blocks

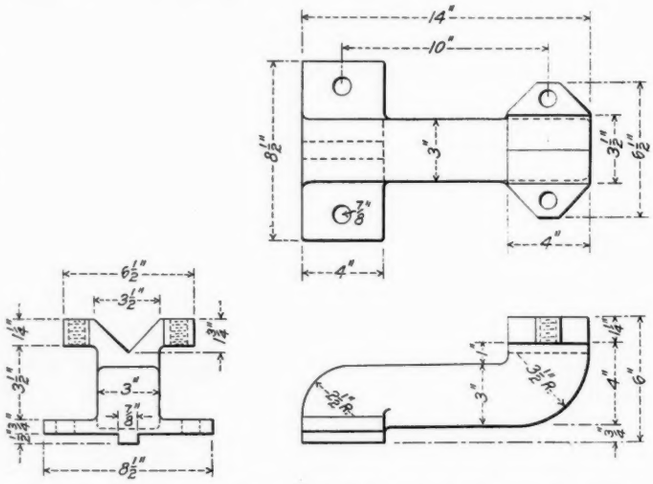


Fig. 54—Overhanging V-Block for Use on a Crank Planer.

are made of cast iron. The crossheads are planed with the piston rods keyed to them to insure perfect alinement with the rod. A master bar cannot be used because of the difference in taper and the size of holes for the piston rod fit on different classes of locomotives.

SUSQUEHANNA SHOPS, ERIE RAILROAD.

BY H. L. BURRHUS.
Assistant to General Foreman, Susquehanna, Pa.

FIRE RAKES.

Dies and tools for making fire rakes in three operations, after the iron is cut to shape, are shown in Fig. 55. The machine for bending the handle is shown at the lower part of the illustration. A roller A is fastened to the wheel under the bed plate, which is turned by admitting air to the cylinder C, causing the pin or roller A to travel around in the grove B. A rod is placed between A and D and is bent into proper shape for the handle when the above operation takes place. A stop, not shown on the drawing, is placed just beyond the letter B to

gage the proper length of stock for the handle. The hot iron must first be bent slightly so that the straight portion of the bar will fit between the two parallel bars that are riveted to the top of the table, while the hot end extends between A and

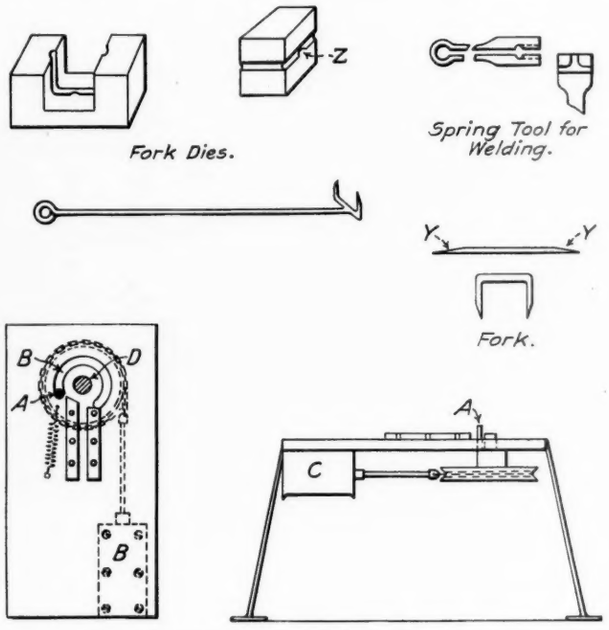


Fig. 55—Tools for Making Fire Rakes.

D and rests against the stop. A spring attached to the wheel under the bed plate quickly brings the roller A back to the initial position after the handle is bent.

The hook or fork part of the rake is sheared to the required length with the ends pointed as shown. It is then bent in the dies, the point Z on the male die making the proper scarf in the center of the fork to weld the handle to. These dies can be made for a bull-dozer or for use under a steam hammer. The handle and fork are welded together with the spring tool shown in the upper right hand corner of the illustration. The weld can also be made in an up-setting machine. The end of the handle is cut at the necessary angle for properly welding to the fork. These tools are inexpensive and may be made of old material usually to be found about a railway repair shop.

REMOVING CAR WHEELS.

A scheme used in connection with a car wheel press, so that car wheels may be applied or removed without changing the heavy movable head on the press, is shown in Fig. 56. It is simple and inexpensive, and saves considerable time ordinarily

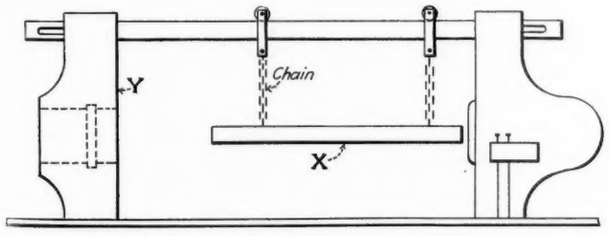


Fig. 56—Simple Device for Removing Car Wheels.

required for changing the press. The bar X may be made of an old piston rod, and when not in use may be unhooked from the supporting chains and placed to one side out of the way. To remove the wheels from the axle, hang the bar on the chains and roll the wheels in the press so that the inside face of one wheel rests against the surface Y. The bar is hung on rollers, as shown in the drawing, so that it may easily be moved back and forth with the plunger.

PUNCH FOR STAYBOLT TELL-TALE HOLES.

A punch used in a bolt heading machine for punching and countersinking tell-tale holes 1¼ in. deep in staybolts at one operation is shown in Fig. 57. The body of the punch may

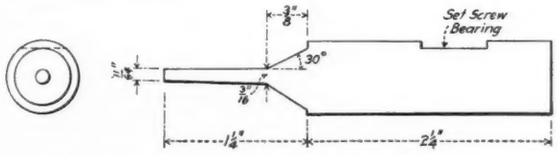


Fig. 57—Punch for Staybolt Tell-Tale Holes.

be made any size to suit the machine; a tool of this kind will punch from 2,000 to 4,000 bolts without bending or breaking. It should be made of tool steel and in tempering care should be taken not to make it too hard. If tempered to a light blue it will give the best results.

SPEED REDUCER FOR AIR MOTOR.

A speed reducer used in connection with an air motor is shown in Fig. 58. This device is especially useful in reaming holes, as it is powerful and runs smoothly. It does not operate fast enough to burn the reamer, but makes a slight cut at every revolution. Large holes may be drilled easily with this device. It is also used to pull in valve or cylinder bushings when they

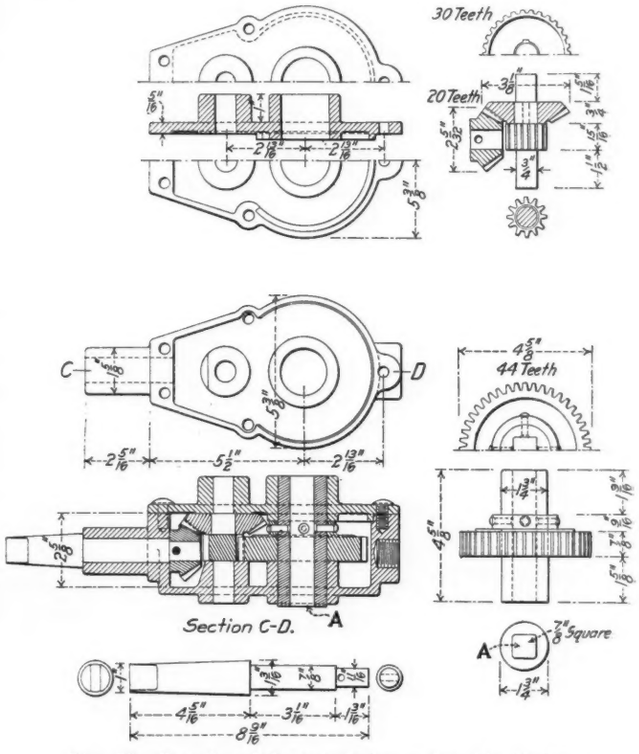


Fig. 58—Details of Speed Reducer for Air Motor.

are put in cold and are pulled in with a rod and nut. In this case it is necessary to have a hexagonal hole in the center gear the size of the nut used on the drawing-in rod. The machine is geared at a ratio of 5 to 1, and the bushing has to fit pretty tight to stall the machine, after it has once started.

DRILLING KNEE OR "OLD MAN."

A servicable drilling knee or "old man" which is intended for use in the boiler shop, but has been found useful in repairing steel cars and also in the locomotive erecting shop is shown in Fig. 59. The upright or support is made of 2-in. steel tubing or heavy pipe about 30 in. long with a rod running through the center; the knee or arm may be adjusted on the tubing by a set screw. When once the upright is set a number of holes

may often be drilled without changing the base. Another good point is that on a rounding surface the base may be blocked with wood allowing the drilling knee to be set at almost any angle. By bending the rod at its lower end and blocking the

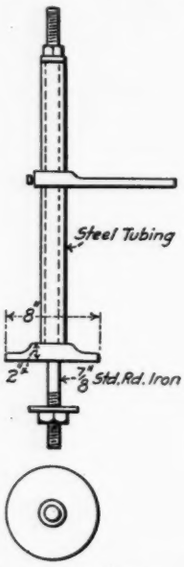


Fig. 59—Drilling Knee or "Old Man."

base in this way it is possible to set the drilling knee at an exceptionally large angle from the position it would normally occupy. The device is especially useful in drilling mud ring corners.

SOCKET WRENCH.

With the wrench shown in Fig. 60 it is not necessary to use a lever bar to tighten up a nut. The wrench is so designed that

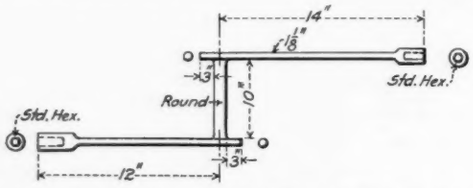


Fig. 60—A Socket Wrench Which Does Not Require the Use of a Bar.

good leverage can be obtained by grasping the projections extending beyond the bends. Wrenches of this kind can be made all sizes to suit any work.

PREPARING CYLINDERS FOR AIR HOISTS.

A cheap and good way to prepare a piece of pipe for the cylinder of an air hoist or an air jack is shown in Fig. 61. Fill

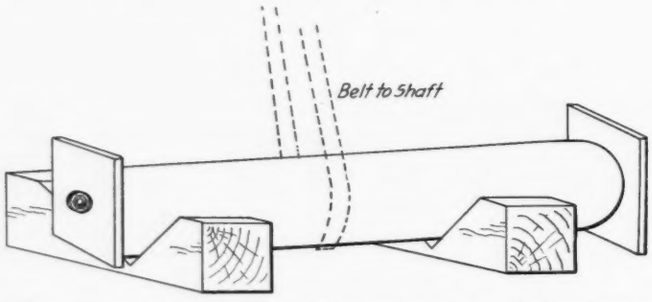


Fig. 61—Device for Finishing the Inside of a Cylinder for an Air Hoist.

it about half full of sand and pieces of iron scrap; also two or three long pieces of round iron or pipe. Bolt a piece of wood over each end with a rod extending through the center as shown in the sketch; place the pipe on V blocks and revolve by running an old belt around the center and over the line shaft. The action of the sand and pieces of scrap on the inside will smooth and polish it nearly as perfectly as it can be bored on a machine. The long pieces of round iron wear down the ridges or high spots. Care should also be taken to select pipe with as smooth an inside surface as possible. In one case in which the pipe was quite rough on the inside we used several pieces of round iron and pipe without any sand. After revolving the pipe one day the bumps and ridges were worn down. When once started in operation the device does not require attention and it may be run two or three days, or until the inside is perfectly smooth. We have finished the inside of both cast iron and wrought iron pipe from 48 in. to 84 in. long in this way.

BORING TOOL FOR BUSHINGS.

A handy tool for boring and turning air pump bushings is shown in Fig. 62. It is so arranged that two cutting tools, ¾ square, both cut at the same time. One tool turns the outside while the other tool bores the inside. Both tools may also be

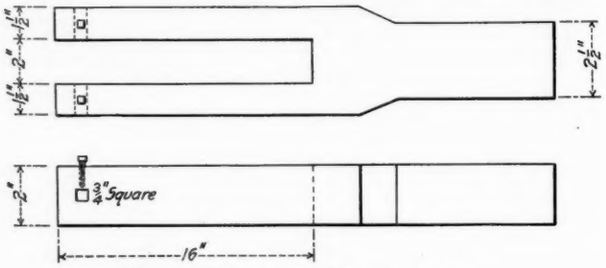


Fig. 62—Boring Tool for Bushings.

used for boring a cylinder by turning one tool upside down and reversing the tools so that they both face out from the holder. When used in this way two cuts are taken on the inside at the same time. While the tool is intended for machining air pump bushings, it may be made any size to suit other work.

MACON SHOPS; CENTRAL OF GEORGIA.

BY W. H. FETNER.
Master Mechanic, Macon, Ga.
Credit also due to C. L. Dickert, General Foreman.

SMALL AIR-OPERATED BENDING MACHINE.

The portable air-operated bending machine shown in Fig. 63 was built for bending small work, such as car brake hangers,

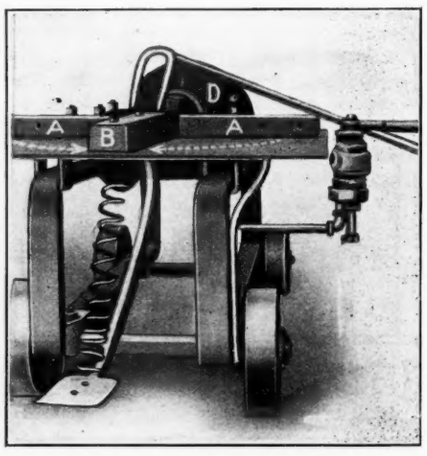


Fig. 63—Portable Air-Operated Bending Machine for Small Work.

stake pocket bolts, etc. The cylinder D is an old 12-in. brake cylinder with a suitable crosshead fitted on the end of the piston rod. The bending arms A are pinned loosely to the table at

their inner ends and are connected to the crosshead by links. When the piston is forced outward the arms travel as indicated by the arrows. The forming block B is shaped to give the desired size and form to the parts that are being bent. The bending arms A have two holes drilled through them for bolting on different sizes of forming plates. A treadle, fulcrumed to the bottom of table, is connected to a grip block and clamps the work to keep it from slipping while being bent. Fittings for all kinds of bending are provided. This is a very handy machine for the smith shop.

CLINKER RAKES.

The dies shown in Figs. 64 and 65 are used to weld the forks of clinker rakes to the handles. The dies were designed for use in a 2½-in. bolt heading machine, but this work may also be done in a forging machine or a bulldozer. Fig. 64 shows the fork and handle in position for welding. After being welded the fork is bent to shape in the bending machine shown in Fig. 63. By this method the operator may weld and bend the rakes in one heat; 300 rakes have been welded and bent in nine hours. The fork is made of 1-in. round iron taken from scrap material and is cut to length and pointed in a bolt header or under a steam hammer. The handle is made of ⅞-in. round iron and is cut to the length required. The handles are bent on an eye-bending machine, 500 being bent in nine hours. The total labor cost of making the rakes complete is 4½ cents per rake.

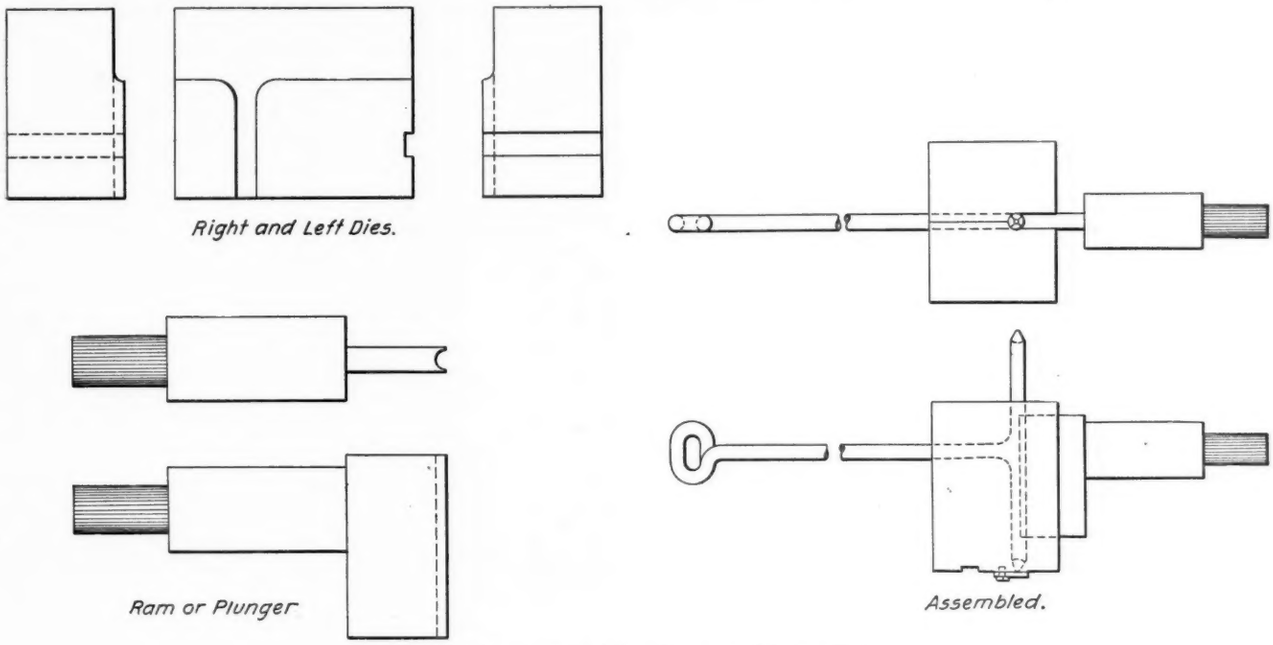


Fig. 64—Dies for Welding Fork on Clinker Rakes.

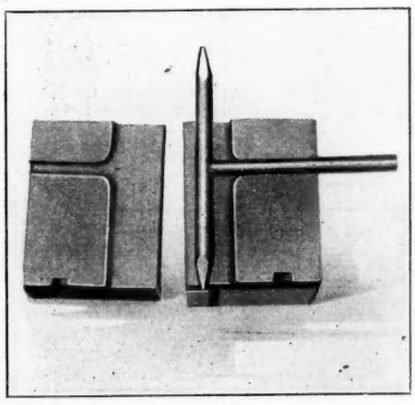


Fig. 65—Dies for Welding Fork on Clinker Rakes.

TIRE HEATER.

A portable oil tank and heater for use in connection with a tire heating ring is shown in Fig. 66. This is a simple and economical device for removing or applying driving or truck wheel tires in an engine house. The oil tank A is an old 12-in. x 33-in. auxiliary reservoir. A ⅜-in. feed pipe extends from the tee just above the top head down into the tank and to within one inch of the bottom. One end of the tee is connected to the ¾-in. supply pipe C, provided with a check valve, which goes to the heater B. The other end of the tee is connected to the air supply, which may be throttled down to give the desired mixture for proper combustion. At the side of the tank is an air pipe connected to the air system through a reducing valve set to 20 lbs. This gives the pressure necessary to drive the oil from the tank A through the heater B to the ring. The heater B, made from an old 12-in. air brake cylinder with 9 ft. of ¾-in. pipe coiled inside of it, heats the oil, forming a gas. This pipe comes out of the heater at D and is connected to the pipe extending to the heating ring by a coupler at E.

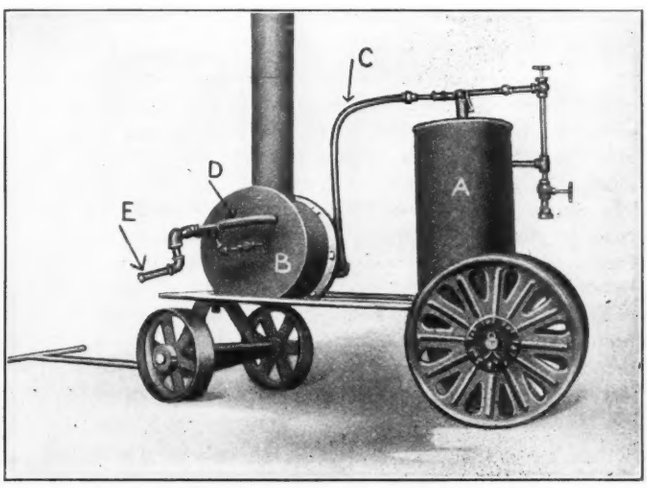


Fig. 66—Tire Heater.

The heater is heated by wood, charcoal or by a burner fed from the oil pipe. The tire heating ring is made of 1-in. pipe, with openings ½ in. long and the width of the hack saw blade used, which gives a good wide flame. This arrangement comes in very handy where driving tires are to be tightened at outlying points.

CYLINDER PACKING RING SAW.

The machine illustrated in Figs. 67 and 68 was devised to save time and labor in cutting and fitting cylinder packing rings. Ordinarily they are cut with a hack saw and filed to fit, which

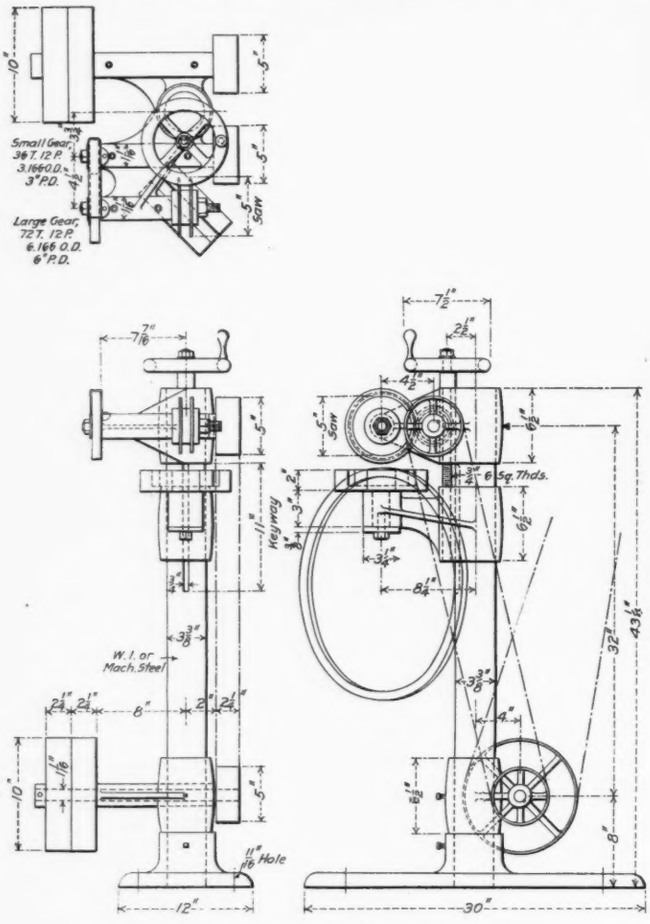


Fig. 67—Cylinder Packing Ring Saw.

usually takes from 15 to 30 minutes; with this machine the same work may be accomplished in one minute, making a much better fit. The 1/16-in. x 6-in. slitting saws are used with an adjustable collet between them to give the desired width of gap. The ring is held in a swivel chuck, making it possible to cut the rings at any desired angle. The chuck may be raised or lowered by the hand-wheel and ¾-in. screw. The rings are gripped in the chuck by set screws. The machine as shown is belt driven, but by extending the driving shaft with a suitable connection either an air or electric motor may be used, and it may then be readily converted into a portable machine, if it is desired. It has been used for three years with splendid results.

ASH PAN HOES.

Dies for welding the blades on ash pan hoes are shown in Figs. 69 and 70. Die A is cut away to the depth of the hoe blade and is grooved to conform to the rods used. Die B is cut to the depth of one-half the diameter of the rod and is grooved to match A. The face of plunger C is made the full width and length of the hoe blade, and is grooved with a radius of 13/16 in., which is one-half the diameter of the rod plus the thickness of the hoe blade. The groove laps the blade half way around the hoe back, making a strong and neat looking weld. The dies are used in a 2½-in. bolt machine. Before using these dies a cross-rod must be welded to the end of the

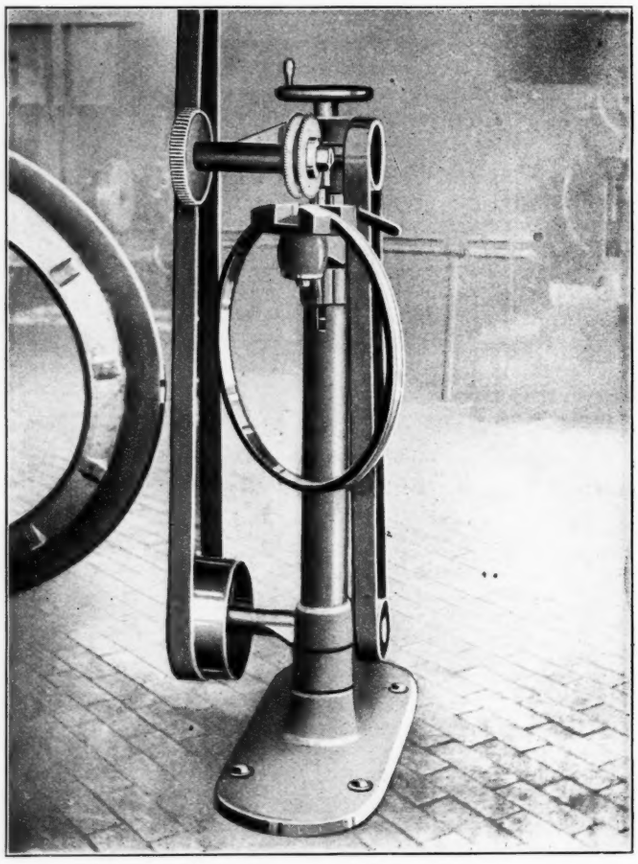


Fig. 68—Cylinder Packing Ring Saw.

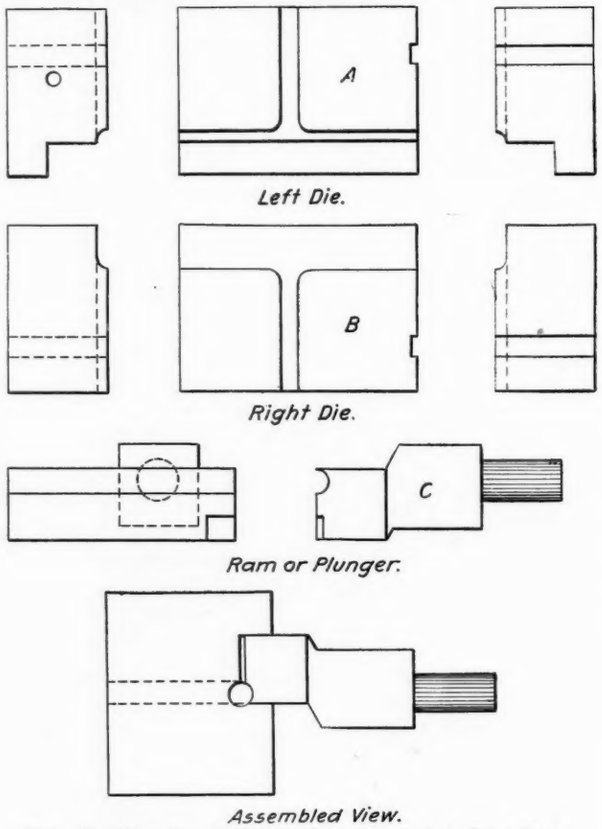


Fig. 69—Dies for Welding Blades on Ash Pan Hoes.

handle similar to that used for the clinker rakes, the same dies, Figs. 64 and 65, being used. After the desired number of cross-pieces have been welded to the handles the dies are replaced in the machine by those for welding on the hoe blade. The rods used are

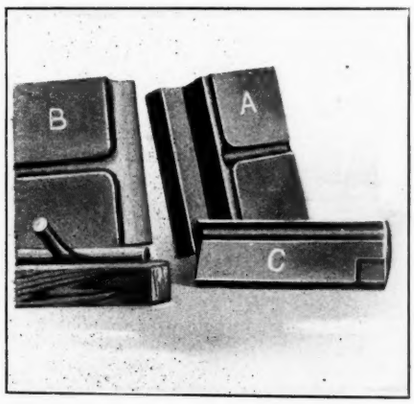


Fig. 70—Dies for Welding Blades on Ash Pan Hoes.

1-in. round iron taken from scrap and the blades are cut from scrap boiler plate. One hundred and fifty of these hoes may be welded in nine hours. The eyes in the handles are bent in an eye-bolt machine.

BUFFALO SHOPS; PENNSYLVANIA RAILROAD.

BY C. C. LEECH.
Foreman, Buffalo, N. Y.

PNEUMATIC CARPET CLEANER.

A simple arrangement for cleaning carpets with compressed air is shown in Fig. 7. The carpet is first rolled on a wooden roller, which is hung in the brackets A. One end is then carried up over the rollers and underneath the air pipe B, which has a 1/16-in. slot on its underside where it comes in contact with the carpet. The air blows the dirt out of the carpet, which is slowly moved along until the end can be made fast to the roller C. The remainder of the carpet is then drawn slowly through the machine by revolving the roller C by the hand wheel at the side of the machine. When the carpet has been wound on the roller C it may be removed by lifting the hinge E on the frame. The frame is constructed of wood.

HOIST USED FOR RIVETING YOKES ON COUPLERS.

When riveting yokes on couplers it is desirable to have a special hoist by which the coupler may easily be handled and

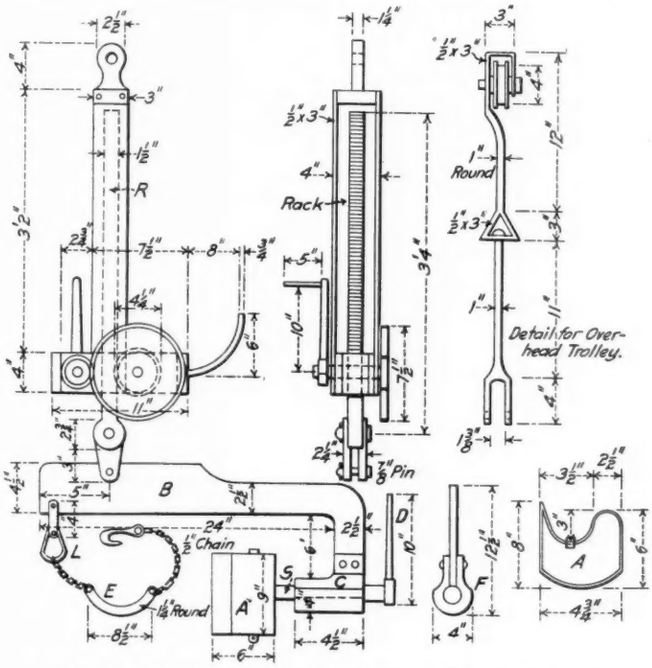


Fig. 72—Hoist Used for Riveting Yokes on Couplers.

turned over. The hoist for this work, shown in Fig. 72, consists of two ½-in. x 3 in. pieces of iron, between which iron blocks are riveted at the top and bottom. The rack gear R is

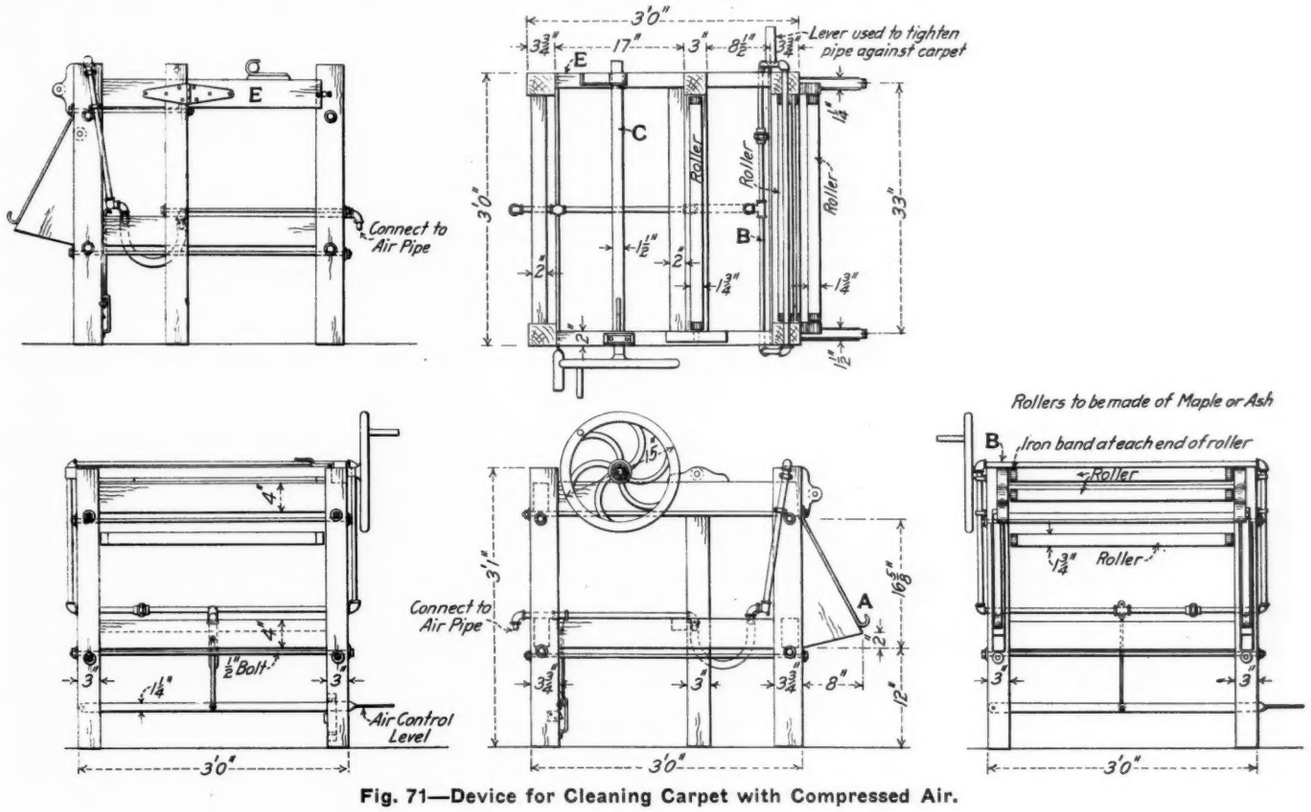


Fig. 71—Device for Cleaning Carpet with Compressed Air.

raised and lowered by the hand wheel and the spur gears. At the lower end of the rack is a wrought iron bracket B. The piece A, which is fastened to the spindle S, is made of ½ in. boiler plate and is so designed that it fits freely into the coupler and knuckle, and may be turned by the handle D. At the other end of the bracket B is suspended a piece of ½-in. chain. In lifting the coupler from the ground this chain is passed around the shank of the coupler, which rests in the piece E, and the hook at the end of the chain is slipped into the loop L. The coupler can be lifted to the proper height for riveting by operating the hand wheel and the rack R, and may easily be turned over or swung into any position under the hammer. A lug consisting of a piece of ¾ by 2 in. iron is riveted on the inside of A and is bent at one end, projecting beyond the edge of A. On the other end it extends far enough beyond A to allow a pin to be put in after the coupler has been dropped into place. This prevents the coupler from falling out when it is turned over. An overhead trolley, the details of which are shown in the drawing, may be constructed, so that the coupler can readily be carried to and from the hammer.

PORTABLE STRAIGHTENING PRESS.

The portable straightening press, which is shown in Fig. 73, is used largely for straightening main and side rods and in applying or removing bushings from them. The base of the truck is an iron casting and is mounted on 10⅛-in. wheels with 3-in. treads so that it may easily be moved from one part of the shop to another. The uprights and the top cross piece are forgings; the screw, which is 3¼ in. in diameter, is threaded for a distance of about 20 in.

PORTABLE BENDING AND UPSETTING MACHINE.

The portable bending and upsetting machine shown in Fig. 74 has for its base a 12 in. x 4½-in. I-beam, which is reinforced

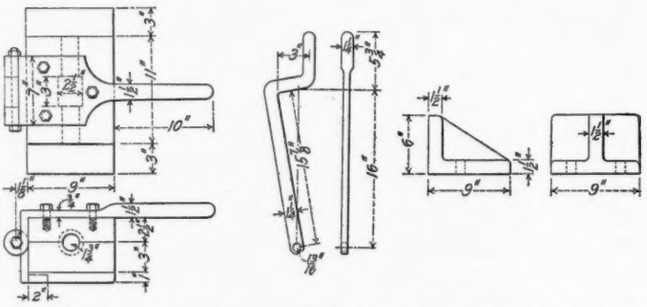
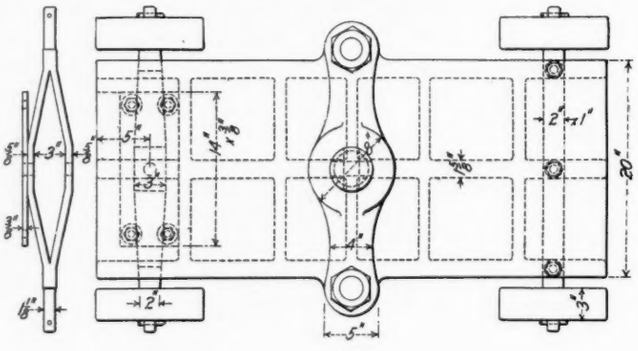


Fig. 75—Details of Hinged Die Used on the Portable Bending and Upsetting Machine.



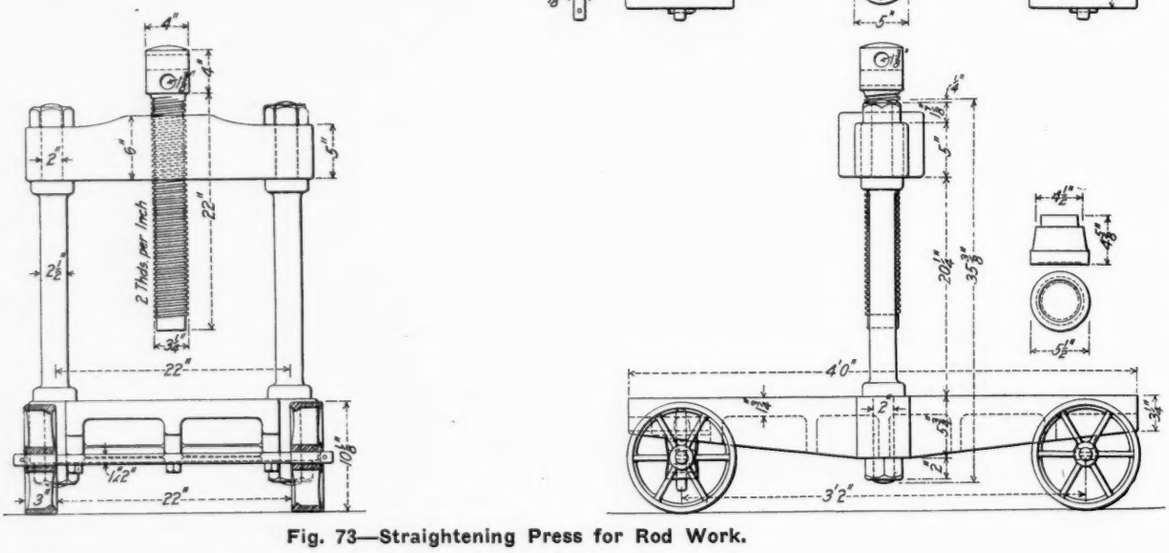


Fig. 73—Straightening Press for Rod Work.

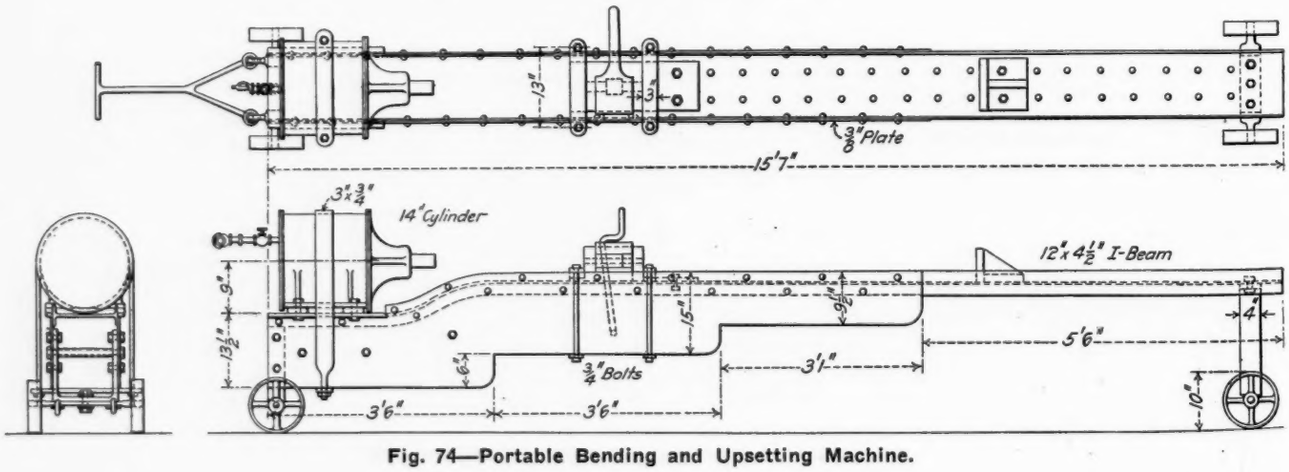


Fig. 74—Portable Bending and Upsetting Machine.

at the sides on one end by 3/8-in. steel plates. The 14-in. air cylinder is bolted and strapped to the bed, as shown. The machine is especially useful in the blacksmith shop for upsetting brake shafts, making brake hangers, bending uncoupling rods, etc. The adjustable hinged die near the end of the machine is shown in detail in Fig. 75, and is used for holding the shaft

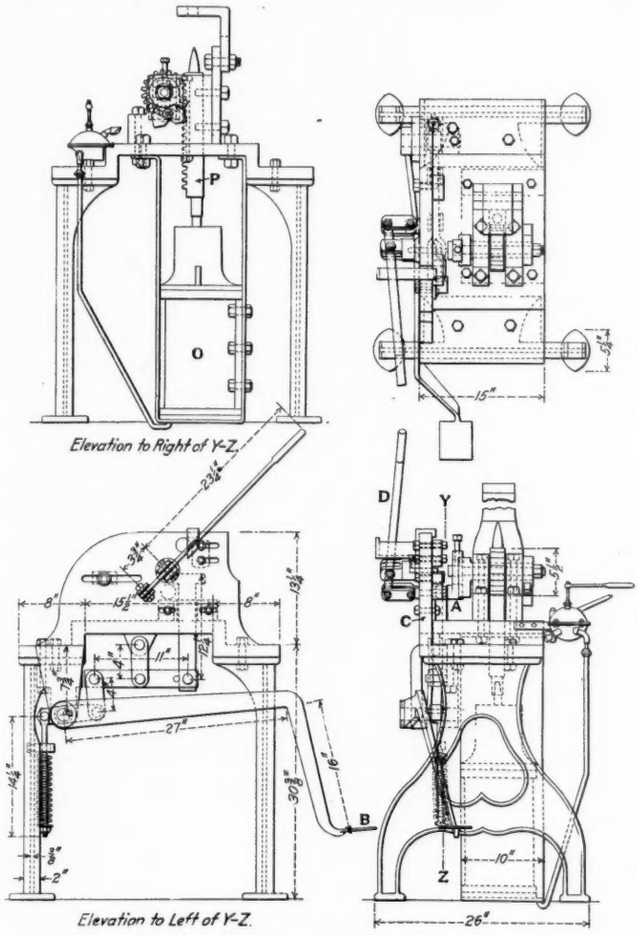


Fig. 78—Eye-bolt Bending Machine.

at the point where it is to be upset to make the shaft large enough to form the square part on which the ratchet wheel fits. The square portion is formed under a steam hammer or in a bulldozer. The bracket or stop near the other end of the machine is used for backing up the stock that is to be bent and may be adjusted for various lengths of work by using the different sets of holes in the web of the I-beam. The machine was originally built for brake shaft work but was afterwards modified to do the other classes of work mentioned above.

BENDING CLAMP.

A convenient bending clamp for use in the boiler shop is shown in Fig. 76. It consists of a cast iron base, supported at its ends on substantial wooden blocks. The clamp is a 12-in. steel I-beam, reinforced on either side along the web by 5/8-in. steel plates, which are riveted to the web. It is operated by the hand screws at each end, and is especially valuable where there is not work enough to warrant the use of a power clamp.

TABLE OR REST FOR EMERY WHEEL.

A simple and convenient table for use with a grinding wheel is shown in Fig. 77. It can be adjusted so that its surface is

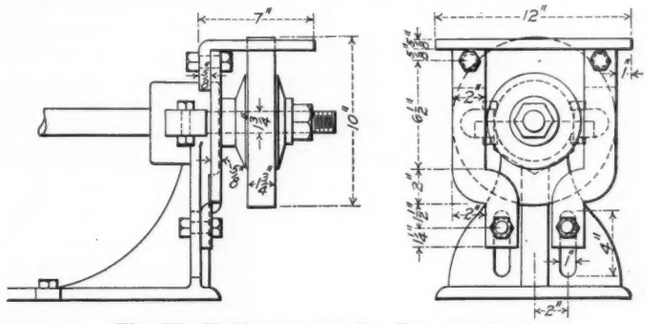
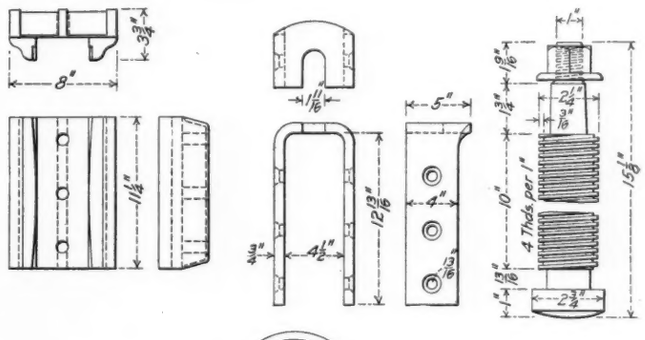


Fig. 77—Table or Rest for Emery Wheel.

slightly below the top of the grinding wheel, and will be found especially useful for grinding light work.

EYE-BOLT BENDING MACHINE.

An air operated eye-bolt bending machine is shown in Fig. 78. The rack P is forced upward by the air cylinder O, thus revolving the arm A, on the end of which is a pin over which a roller, whose size depends on the size of the eye and the stock, is slipped. The heated iron is placed in the machine just above



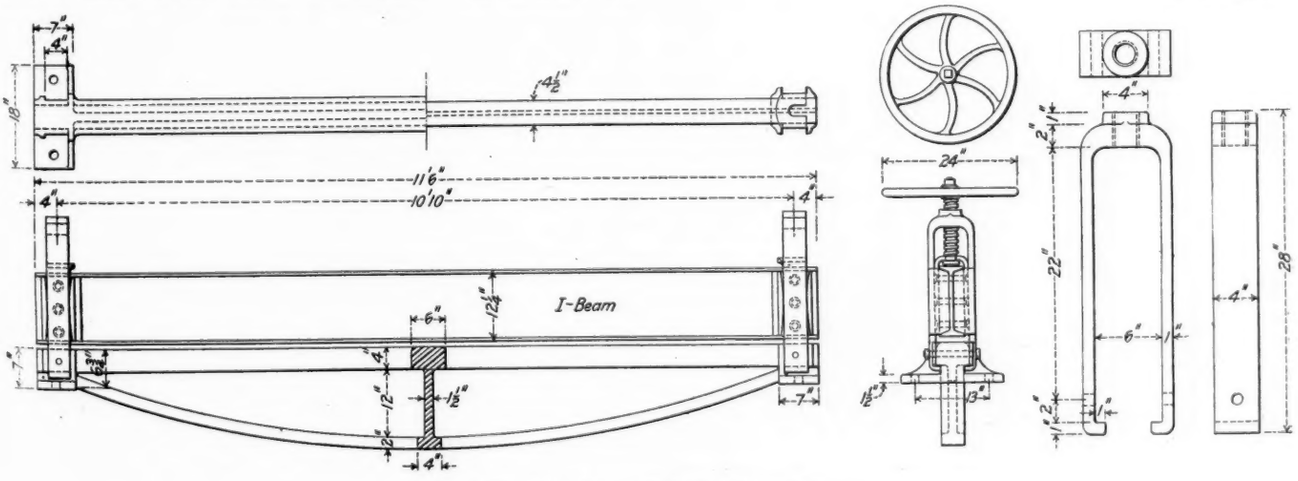


Fig. 76—Hand-operated Bending Clamp.

this roller and is clamped by operating the foot lever B. This forces the large pin upward clamping the stock between its head and an adjustable lug or stop above. A pin whose diameter is the same as that required for the eye of the eye-bolt, is forced inward by means of the lever D. Air is admitted to the cylinder and the arm A describes a circle about this pin, the roller forming a perfect eye on the stock. The pressure is then removed from the foot lever and the stock is automatically relieved by the action of the spring. The machine may be adjusted for any size eye-bolt or diameter of stock. It does not, of course, form a welded eye.

CAR INTERCHANGE.*

BY T. W. DEMAREST,
Superintendent Motive Power, Pennsylvania Lines, Fort Wayne, Ind.

There is, apparently, more or less of a general impression that, in order to facilitate the movement of freight cars between connections with a minimum of delay, some positive change in present methods is necessary. With the exception of some of the larger terminals, the railways are supposedly governed by the M. C. B. rules of interchange. At many of the larger terminals, to better meet the conditions, the M. C. B. rules have been modified by local agreements which vary in detail. Apparently, none of these have proven entirely satisfactory, as there was presented to us some time since a proposed new code to be known as the "run-repair-or-transfer-system." There is only one general code to which all roads are amenable, i. e., the M. C. B. code of rules, and, before advocating a new code, it would seem pertinent to establish, first, that the M. C. B. code is deficient, and, second, in what respect. The requirements of an adequate system of interchange are, first, safety; second, protection to the car owner, and, third, maximum speed of movement of the car and lading or car between connections with a minimum of expense.

For the past three years the American Railway Association, through its committee on car efficiency and the committee on relations between railways, has given a great deal of attention to the interchange of cars and reports of cars interchanged. So many weaknesses developed that it requested the appointment of a joint committee of the Master Car Builders' Association and of the Association of Transportation and Car Accounting Officers to investigate conditions throughout the entire continent, if necessary, and to report on them. In response to this request a joint committee was created by the action of the Master Car Builders' Association, viz., the arbitration committee and the Association of Transportation and Car Accounting Officers, the joint committee being created in June, 1909. This committee at a meeting held January 26, 1910, at the headquarters of the Master Car Builders' Association, Chicago, decided as follows: (1) To ascertain whether a system could be devised to improve the accuracy of reports of cars interchanged; (2) To endeavor to ascertain what, if any, modification should be made in the M. C. B. rules as they exist which would tend to expedite the movement of cars and at the same time conserve the safety of operation. It was further decided that the only method which would furnish definite data would be a practical test.

In view of the commanding position of Chicago as a railway center and the consequent magnitude of interchange at that point, it was decided that the test should be made in Chicago, and, because of the compact situation and also because of the report of a sub-committee appointed by the General Superintendents' Association of Chicago, the Union Stock Yards district was selected as the most desirable district in which to make the test. The approval of the General Superintendents' Association of Chicago was duly received and the test inaugurated July 1, 1910. After the plan had been in effect for ninety days, it was extended to June 30, 1911.

Before inviting your attention to the results obtained, it seems advisable to review the general question of interchange in Chicago, the various modifications made in the interchange system and the conditions existing under the present system. In reviewing this early history and various rules and agreements covering the interchange of cars at Chicago and vicinity, we find that at a convention of the railway superintendents and master car builders held at Chicago on December 14 and 15, 1876, a revised set of rules was presented and adopted governing the conditions of and repairs of freight cars for the interchange of traffic. This code of rules, apparently, remained in effect for a number of years, but, as its requirements were not generally followed, defect cards not always being furnished when requested and cars refused and returned contrary to the rules, causing delays, the question of improvement became necessary. The late Peter H. Peck at the December, 1889, meeting of the Western Railway Club, presented a paper treating on the conditions as they existed at that time. This paper contained the statement that the daily interchange ranged from 4,000 to 7,000 cars, and that 30 per cent. of the cars offered in interchange were in a more or less defective condition with cardable defects. The causes of the delays were very clearly brought out by Mr. Peck, and he advocated the adoption of a joint inspection arrangement and the formation of a committee to present a new set of interchange rules. The committee was duly appointed by the Western Railway Club, January 1, 1890, to recommend a joint interchange card and a set of rules governing the use of such a card in order to facilitate the prompt handling of loaded and empty cars between lines centering in Chicago.

This committee recommended the use of the "Chicago joint defect card," and rules providing for the use of this card for old defects or missing material, and where the delivering line inspector was located so far from the receiving yard that it would be impracticable to procure a regular M. C. B. defect card. The rules and the "Chicago joint defect card" were adopted by a number of the roads at that time, and later on (about September, 1893) the General Superintendents' Association passed a resolution that the rules be adopted on all lines at Chicago.

These rules also proved inadequate, and we find reference made to a new interchange plan at the meeting of the Western Railway Club, November, 1894, at which meeting the chairman of the committee advised that two meetings had been held at which a large number of roads centering in Chicago had been represented and that they had formulated a small code of rules for the interchange of cars, auxiliary to the M. C. B. rules of interchange. Reference to this new agreement is also found in the proceedings of the Western Railway Club for 1895.

[Here follows a history of the various changes in the use of the defect card by the M. C. B. Association and the various Chicago associations, governing inspection in the Chicago switching district and the stock yards, and covering a period of 17 years, from 1893 to 1910. The paper also contains an appendix giving the various rules adopted by the Chicago associations during this time.]

In effect, the interchange of cars in the Chicago switching district is handled under the M. C. B. code of rules, with the vital exception of Rule No. 8 of the General Superintendents' Association of Chicago, reading as follows: "It is understood that in the interchange of cars within the Chicago switching district the parties to this agreement will accept, as their own, the record of the receiving line, so far as the condition of the car is concerned, and that M. C. B. defect cards will be furnished for such defects when proper request is made, if based on M. C. B. rules and this agreement." In other words, the cars are received on notation, and defect cards are requested after receipt of the car. In this connection, attention is also called to Rule No. 10 of the General Superintendents' Association, reading as follows: "Defect cards shall be issued by the delivering company when justified under the M. C. B. code of rules governing the interchange of cars, within sixty days from date of request, ——."

* Abstract of paper read at a meeting of the Western Railway Club, February 21, 1911.

The consequences can readily be imagined, and we who are interested in the interchange at Chicago are all acquainted with the results (1) that as the car is received on notation and request for defect card made after car is received, it is not possible to hold the car until the receipt of the card, and to avoid delay it must be permitted to go forward; (2) that requests for defect cards are not promptly honored, and in a great many instances the receipt of the card is so delayed that the car is not only away from the terminal but entirely off the line of the receiving road before the defect card is received; (3) there is brought about an expensive system of tracing cars, not only on the receiving line, but also between connections. (To cover this situation there has grown up the practice on some roads in the Chicago interchange of applying to a car on receipt the so-called "condition card" as a substitute for the M. C. B. defect card, which "condition card" shows all the information shown on the M. C. B. defect card and requires the same length of time to make out and apply); (4), failure to furnish defect cards by the delivering line to the receiving line on request.

The number of unsettled claims for defect cards, as above, due all lines became so great during the early part of the year 1908 that the lines interested decided that some arrangement must be effected whereby defect cards due the various lines would be furnished and the records closed. Meetings of the superintendents of motive power of the various lines interested were held April 21 and July 31, 1908. A. E. Manchester, superintendent motive power of the Chicago, Milwaukee & St. Paul, was elected chairman, and, after a thorough discussion, it was decided that all roads be requested to send a representative to a meeting to be held on August 23, with the further request that each representative attending the meeting submit a statement showing the number of unsettled claims against their connections.

At the meeting held on August 23 representatives of twenty roads reported a total of 17,886 outstanding claims for defect cards due from connecting lines. While at this meeting the representative of one of the lines interested reported having settled 9,822 claims since the meeting of July 31, it appeared that the general situation was no better than at the first meeting held on April 21. A committee of seven was appointed to be known as "The Special Committee On Defect Card Claims," with the understanding that the matter would be taken up with the General Superintendents' Association and with the suggestion that the special committee be given full authority to act for the General Superintendents' Association.

Since the above period the situation has been getting very much worse, and at a meeting of the special committee held on January 14, 1911, it was found that, although the committee had settled a total of 97,730 cases from June 1, 1909, to January 1, 1911, and that 7,779 of these cases were settled during the month of December, 1910, the total number of unsettled cases on December 31, 1910, was 12,103. The special committee on defect card claims is still endeavoring to devise some plan to better this situation.

I think the injustice of the situation will be evident to all of you. It would appear that a simple solution of the entire question could be practically worked out, and that is by the application of the defect card upon receipt of the car.

In view of the general statements that have been made from time to time that the M. C. B. rules which provided for the above condition were not sufficiently elastic to apply to large terminal interchange territories; in view of the variations made from the M. C. B. rules at large terminals said to be on above account; and in view of the general situation as it evists in Chicago, the joint committee appointed by the American Railway Association decided that, in addition to endeavoring to devise a plan for improvement in the car interchange record, it would also endeavor to ascertain in what respect the M. C. B. rules were defective, with the view of not only reporting to the American Railway Association and the Master Car Builders' Association the success of the trial method and the car interchange record, but also what changes it would be necessary to make in the M. C. B. rules. The Union Stock Yards district was selected as the district to be covered by the trial and a joint car inspection and interchange bureau established at that point July 1, 1910. This bureau, besides the usual work of inspecting and carding cars in interchange in accordance with the M. C. B. rules, carries, in addition to the physical condition record of cars, a record of seals, commodity, point of shipment, final destination, and time of interchange. The territory included covers an area of about six square miles with approximately 200 miles of track, in addition to private sidings. The principal interchange between the 29 roads interested, including the C. J. and the C. R. & I., is handled at seven points, namely, Loomis street, Ashland avenue, 47th street and Center avenue, 40th and Halsted streets, Wabash Elevator, Santa Fe Elevator, and 34th and Iron streets. There are approximately 3,000 cars interchanged at these points every 24 hours.

The work of inspection and recording of data required by the car accountants is handled by a force of one chief interchange inspector, four foremen (three day and one night, the time of two of the foremen being almost entirely engaged in representing roads in making settlements for damaged cars with private car owners), one chief clerk, one assistant chief clerk, three clerks on miscellaneous work, seven typists and two messenger boys. The expense of the bureau is divided on a basis of 45 per cent. to the transportation department and 55 per cent. to the mechanical department, at an average cost per car interchanged of about $0.028 and $0.037 respectively to each department.

The bureau, as stated previously, was started July 1, 1910, for a three months' trial period. On September 1, 1910, owing to difficulties experienced in perfecting the organization due to the necessity of educating the inspectors in regard to the proper application of the M. C. B. rules and carding for delivering line defects, also on account of the resignation of the chief interchange inspector and chief clerk, it was decided by the General Superintendents' Association to continue the trial until July 1, 1911; it being understood that cars would be interchanged strictly in accordance with the M. C. B. rules, except Rules Nos. 117 and 118 of the 1909 code and Rules Nos. 91 and 92 of the 1910 code, these rules pertaining to the responsibility of switching lines. The efficiency of the bureau has been constantly improving as the men become more familiar with their duties and as the different roads themselves arrive at a better understanding, and we are confident that at the time the trial is ended its operation will be practically satisfactory to all the roads interested.

The M. C. B. rules, with the exceptions as outlined above, have been in effect since the bureau was organized and cars have been carded on receipt from the delivering line by the joint interchange inspectors. Errors in making out the cards have occurred, as is natural, also cardable defects have been passed over, but the situation in this direction has improved steadily and will continue to improve as the inspectors become more proficient in their duties; it being understood that in this district the majority of the interchange inspectors have never been required to become familiar with the use of the M. C. B. defect card. The joint committee to date has not been able to find that the interchange of cars is affected by the application of the M. C. B. code of rules, although there are one or two minor suggestions to make.

The Western Railway Club has always been deeply interested in the car interchange situation, not only generally, but as particularly applied to the Chicago terminal interchange. The joint committee appointed by the American Railway Association, therefore, calls the matter to your attention with the suggestion that the Western Railway Club appoint a committee to investigate the operation of the joint interchange and inspection bureau at the stock yards and report the adequacy or inadequacy

of the M. C. B. rules to handle any interchange situation, the necessity for the Master Car Builders' Association making any changes in its rules at the coming convention, and the feasibility of applying the M. C. B. code of rules to the entire Chicago terminal territory; it being admitted, we believe, that a code of rules which will prove adequate in Chicago will prove adequate in any other terminal situation and obviate the presumed necessity for special local agreements. [After prolonged discussion the club appointed a committee in accordance with the above suggestion.]

PREVENTION OF ACCIDENTS IN SHOPS.*

BY JOHN CALDER.

Industrial accident reporting is still very incomplete in the United States, yet Bulletin No. 78 of the Bureau of Labor, September, 1908, states that, among adult wage earners alone, the yearly mortality from accidents is between 30,000 and 35,000. The non-fatal injuries inflicted can not be much less than 2,000,000 additional. It is believed that, by proper supervision and precautions in all plants and industrial processes and the cultivation of greater care by operatives, at least one-third of the present annual sacrifice of life and limb can be prevented, thus increasing our national assets, and obviating a large amount of human suffering and sorrow. In analyzing many thousands of industrial accidents, with a view to devising remedies, the author has found the following to be the chief causes: Ignorance, carelessness, unsuitable clothing, insufficient lighting, dirty and obstructed workplaces, defects of machinery and structures, and absence of safeguards.

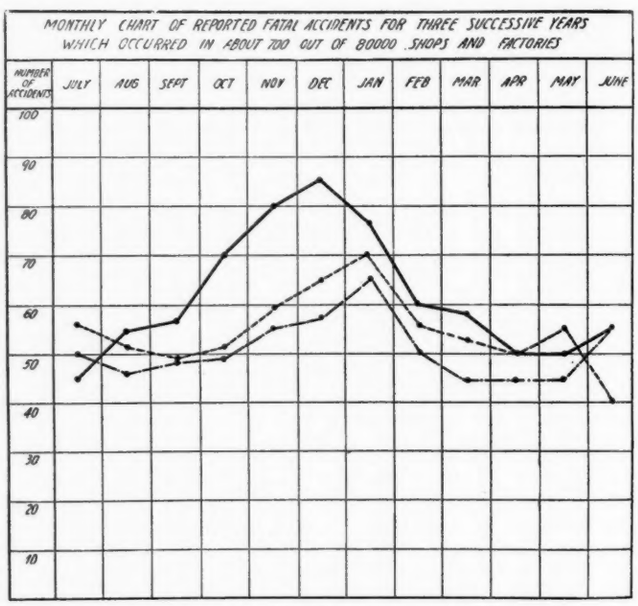
Ignorance.—In spite of ample facilities now afforded to all for the acquisition of some knowledge of mechanical principles, the author has found some superintendents, a number of foremen, many operatives and not a few managing owners of smaller plants grossly ignorant of the nature of the forces and mechanical arrangements which it is in their power either to control, or to set free with resulting danger to themselves and others. It has been a constant matter for regret that organized labor with its unique opportunities has done so little to supplement or complete the mechanical education of its members. Accidents due to the culpable as well as excusable ignorance of supervisors, engineers, millwrights, elevatormen, firemen and guardians of general facilities are frequently very serious and nothing but administrative vigilance in selecting and instructing these employees for their own special risks will suffice to prevent such occurrences.

Carelessness.—Sometimes combined with ignorance, sometimes sheer thoughtlessness, folly or horseplay, carelessness by operatives stands highest as a cause of industrial accidents from the results of which nothing external can do much to shield the worker and those whom he sometimes involves. All plant executives know that many things workmen do and suffer under this head would hardly be credited by the sympathetic outsider with no knowledge of the facts. The bright and nervy American workman, so admirable in many respects, is easily first in taking foolish and wholly unnecessary chances with his life and limbs; chances which in no way add to his efficiency or his earnings. The exaggerated ego manifests itself frequently in ostentatious independence full of danger to himself and to others. The maintenance of strict discipline in the shops, the adoption of salutary punitive measures and the firm elimination of the dangerous employee is all that can be done, in addition to a campaign of education throughout the plant.

Unsuitable Clothing.—Accident is caused at many machine parts which are necessarily exposed near the operator and with which he would never come into dangerous contact but for unsuitable or neglected clothing. The ragged sleeve ends, loose ties and open jackets of untidy machinists have again and again been wound upon seemingly trivial parts in motion and through the powerful effect of coil friction have inflicted frightful and often fatal injuries. Not a few survivors have to thank the inferior strength of the overall or dust jacket for escape.

Insufficient Lighting.—Insufficient lighting is the cause of numerous accidents, and particularly of serious and fatal falls. A maximum of accidents occurs towards the close and beginning of each year, that is during November, December and January, the months of minimum daylight. The accompanying illustration shows the seasonal distribution for three successive years of about 700 deaths annually from industrial accidents which were reported with other injuries from an area embracing 80,000 plants of varying extents. The influence of the duration and intensity of natural light in working hours on fatal and serious accidents is particularly noticeable in such operations as have to be carried on within large spaces, often entirely in the open air and not easily illuminated artificially to the exclusion of deep shadows.

Within plant buildings the intensity of artificial lighting at the cutting point of tools, for instance, and on very limited machine-tool or bench areas is frequently far above actual requirements and a source of much physical discomfort, while all around the operative a semi-darkness prevails which has a blinding effect in the sudden transitions of the vision required by his employment. It has been found by exact photometric observations of shop lighting conditions both during the day and at night, that the concentrated illumination by means of shades of ordinary 16 c. p. incandescent units on cutting tools in machines and the area near them is often several times the intensity of ordinary daylight on the same parts. It is difficult to convince the operative that he is suffering from too much light at any place and the call is constantly for more light. From the safety point of view and from consideration of power economy this excessive hard light on spots only, which causes eye-strain and poor vision of surrounding areas with resulting accident, should be eliminated by good illuminating engineering. A more generally diffused light of less unit intensity is now easily obtained by the use of fewer but larger screened units experimentally located to suit varying shop requirements and reflecting from whitened wall and ceiling surfaces.

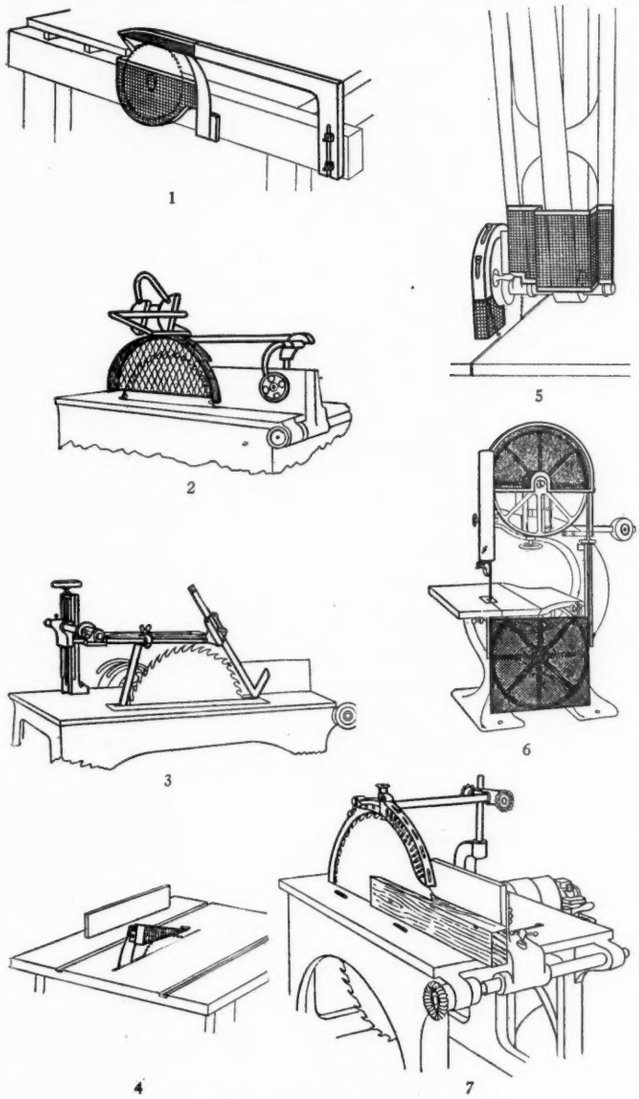


Influence of Daylight on Accidents.

Dirty and Obstructed Workplaces.—Dirty and obstructed work places are closely allied to defective illumination as a source of

*Abstract of a paper on The Mechanical Engineer and the Prevention of Accidents, read at the New York meeting of the American Society of Mechanical Engineers, February 14, 1911. Mr. Calder is manager of the Remington Typewriter Works, Ilion, N. Y.

accident. The literal "shedding of light" on waste and rubbish is often the sure forerunner of their removal and avoidance of accidents due to them. Every management should see to it that the cleaning of floors and passages and the removal of wastes is systematically provided for. Sometimes this condition is due to the habits of the employee himself and he has to be educated to better ways. At other times floor space is economized and machines and workers are crowded together without due regard to safety in moving about in the confined area. The tidy shop



Safeguards for Saws.

1. Mesh Guard for Constant Diameter Overhung Saw Requiring Clear Bench for Sliding Table Feed. 2. Automatic-Positioning Mesh Guard for Variable Diameter Converting Saw. 3. Automatic-Positioning Bar Guard for Variable Diameter Converting Saw. 4. Mesh Guard for Constant Diameter Saw Requiring Clear Bench for Lumber. 5. Adjustable Mesh Guard for Swing Saw and Belt. 6. Band Saw Guarded against Contact at any part and also against Saw Breakage. 7. Adjustable Shield Guard for Variable Diameter Converting Saw.

is less costly in the long run than the dirty one and has a noticeable effect on the morale of the whole establishment.

Defects of Machinery and Structures.—It has been infrequent, in the author's experience, to find machines or processes in operation which were essentially dangerous because of defective design or arrangement, or from lack of repairs or renewals, and thereby liable to break down and cause injury. It certainly does not pay any employer to keep a defective tool in operation; nor is it in the interest of the employee, particularly if he is paid by the task, to use imperfect apparatus which reduces his possible earnings. On the other hand, it is by no means infrequent to find workmen, who have their choice of the best materials and apparatus and who possess the intelligence to apply these correctly, showing a striking disregard for their own safety and that of others, especially in framing structures and arrangements of a temporary nature. Workmen persisting in practices of this nature should be eliminated as unfit and dangerous employees and the ability of any untried operative to construct safe facilities to be used by himself and others should never be taken on trust. Overloaded machines and structures, decayed gangways, worn-out floors and stair treads, unannealed chains and hooks, frayed and stranded ropes and tackle and a host of minor industrial equipment are items which should pass under systematic and intelligent review from time to time as possible sources of accident. Such attention to safety need be no burden. In the daily routine of plants, whether large or small, if machinery and other equipment is properly selected and installed, and hurry calls for repairs promptly responded to by competent people, and the employees made to feel that suggestions as to real or even imagined defects in the apparatus they must use are welcomed, the team work of good organization will help greatly to eliminate avoidable accidents from these causes, which are usually a reflection upon the executives.

THE POSSIBILITIES OF SAFEGUARDING.

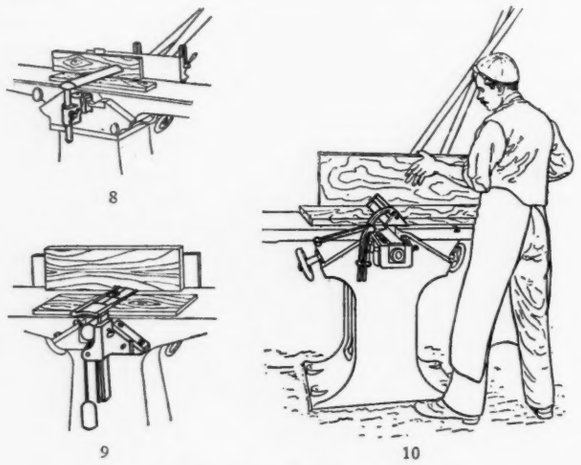
Absence of Safeguards.—In many cases of injuries to operatives caused by the absence of a possible safeguard it will be found that it has been removed or rendered ineffective by the employee for lack of supervision in such matters or that protection has never been provided. Safeguarding absent at one machine is sometimes actually afforded elsewhere under the same roof and the accident is due to the operation of the principle, that what is permitted to be everybody's or anybody's business is in daily life nobody's business. The safety engineering of no plant should be left to the haphazard initiative of a number of individuals. Some degree of finality is necessarily attainable in the simpler forms of safeguards about power houses, transmission machinery and dangerous details common to all machines, and most failures to prevent accidents from these are due to lack of consistency and thoroughness in applying the recognized remedies.

The Machine Tool Builder and Safeguards.—The machine tool builders accomplish a great deal of most useful safeguarding, particularly in protecting the workman from the dangers of toothed gears in metal working and other tools. Now and again, however, a so-called guard is encountered which is simply no guard at all but rather a snare, and which shows conclusively that its designer had appearance rather than utility in mind. Numerous instances might be cited of the vague notion expressed in some current machine designs that anything which looks like a cover for a part of a machine necessarily constitutes in daily service an efficient safeguard; sometimes no regard is paid to the actual direction of rotation or to reversal of motion or to the necessity for frequently removing a clumsy cover which is as likely as not to be left off permanently. The real points of danger in daily operation need to be studied before a satisfactory protection can be provided. A well designed and neatly applied guard on a machine is seldom a prominent feature. Shafts and spindles, low pulleys and belts, intaking sides of gears, narrow clearances between fixed and moving parts, couplings, projecting screws, nuts and pins and numerous similar risks on moving parts of machines are best handled for protection by the machine builder. In any case the safeguarding of these when within the reach of the operator is usually obligatory upon the employer and always desirable.

Guarding of Equipment Built Into Position.—Under this head are embraced all power generators and a very large class of machines and industrial apparatus whose accident risks at dangerous parts depend on the environment, the manner of installation and the precise nature of the workmen's duty around them. Protection against accident at such apparatus is not se-

cured, as is sometimes supposed, by guarding merely the dangerous moving parts. All stationary portions of such prime mover structures as may cause injury to attendants and others should be equally included in the scheme of protection. In power houses the edges of all stairs, platforms, ladders and gratings should have low fenders of metal on both sides which will prevent nuts, bolts, tools and other small parts rolling off into the machinery or striking employees in their fall. In addition a double metal railing not less than 3ft. high and not nearer any moving part than 12 in. should be provided at all dangerous places such as crank and flywheel pits, etc., and at the inside and outside edges of all stairs and elevated platforms. Engine attendants have necessarily to operate often where the footing is slippery and insecure and should be safeguarded when reaching out to bearings close to crank pits and other parts, or in passing around tail-rods and under low fly-balls and other similar parts which can and do cause many serious and not a few fatal injuries particularly on the older prime movers still in service.

Guarding of Transmission Machinery.—The extensive use of multiplied motor drives, properly screened or at a safe elevation, has done away with many transmission belts, shafts, pulleys, collars and couplings in dangerous proximity to workmen. The managers of many industries, however, have still to reckon daily with the accident risks of the older type of buildings and transmission arrangements and the latter when not safeguarded are sometimes the cause of horrible fatalities and ought to be closely scrutinized in every detail. Metal tube and disc guards should be used for shafting, bearings and pulleys requiring to be approached closely while in motion. Seven feet clear of every moving part is considered the least height from the floor level without guarding and, even then, where a horizontal belt drives across a frequented passage at this minimum elevation it is well to have the lower side screened close to the belt to avoid injuries caused by "whipping" when the belt breaks. Special care should be taken to see that all belt shifting and machine starting and stopping gears are positive in their action. Many accidents have occurred at machines through inefficient or defective fast and loose pulley and belt arrangements suddenly starting a tool which was under examination or adjustment.

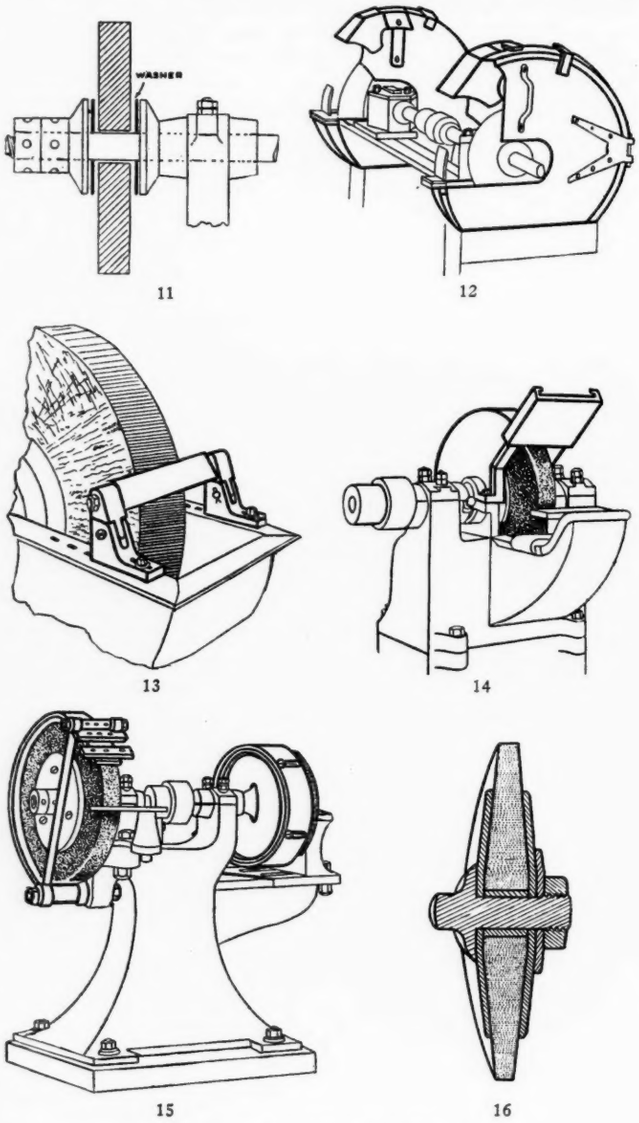


Safeguards for Jointers.

8. Adjustable Jointer Guard. 9. Telescopic Jointer Guard. 10. Automatic-Positioning Jointer Guard.

ESPECIALLY DANGEROUS MACHINERY.

No machine is effectively protected by any guard which hampers a workman, reduces his speed and earnings and has not been designed for the actual working conditions. Such inadequate apparatus is naturally removed by the workman or wholly or partially put out of action at the first opportunity and the particular safeguarding problem becomes the subject of a fruitless triangular controversy between the employer, the employee and the factory inspector. To educate the employee to use caution and foresight about dangerous machines is difficult enough and it should not be rendered more so by calling upon him to work with an impracticable safeguard. What is needed in such a case is careful inquiry by a competent engineer experienced in the study of safeguarding problems into the conditions under which the employee has to operate and a solution, where such is possible, which will enable him to work with efficiency and safety or at least to reduce considerably the accident risk of his occupation.



Safeguards for Grinding Wheels.

11. Safe Mounting of Grinding Wheels. 12. Adjustable Heavy Armor for Disc Grinders Subject to Rapid Wear and Shock. 13. Releasing Grindstone Rest. 14. Safety Adjustable Hood for Disc Grinder. 15. Safety Adjustable Hoods for Disc and Face Grinders. 16. Safety Cone-Formed Grinding Wheel.

Woodworking Saws.—A close approach by the fingers of workmen to sharp cutting tools running at a very high rate of speed is essential in operating efficiently many woodworking saws and cutters. Consider first that king of accident producers, the common circular saw. In spite of claims to the contrary such an article as a universal saw guard does not exist on the market. On the other hand, except in the case of small diameter checking and grooving saws covered by the work, it is quite possible to safeguard all saws to varying degrees conditioned by the uses to which they are put. An efficient as well as a safe saw guard is one which may have to fulfil all or any of the following condi-

tions: (1) The safeguarding must be strongly made and once adjusted must be able to retain its position and form without special care on the part of the operator. (2) It must so protect the saw, both above and below the bench and before and behind the saw, that no one can accidentally touch or fall on the saw. (3) It must not permit the work in a ripping saw to close on the blade, mount it, or be projected to the danger of those around. (4) It must not obscure the workman's vision of the line of the saw. (5) It must be especially adapted to the class of work done on the saw bench and where required must leave all the area of the saw table clear of obstruction and also the space above the guard itself.

The ways in which these conditions for reducing saw accidents, while maintaining efficiency, have been met in the author's experience are shown in the accompanying sketches.

Woodworking Cutters.—The common jointer accounts for a large number of finger and hand amputations every year, and three forms of effective guard are illustrated. In Nos. 8 and 10, two movements, vertical and horizontal respectively, are necessary to adapt the guard to any given piece of work. In No. 9, the guard supported on springs rises automatically when pushed by the work and only the transverse sliding motion is necessary for positioning. After the work has passed the guard the latter returns automatically to a position close to the cutter gap. In the other two types the guards maintain their height above the table until readjusted. All these guards can be readily swung out of the way for cutter adjustments and as easily returned for use.

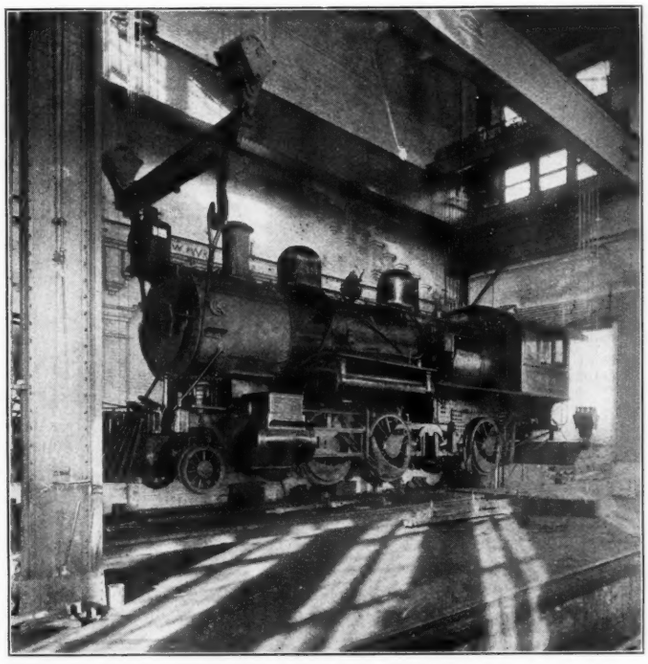
Emery and Other Grinding Wheels.—Emery wheels, grindstones and other abrasive tools when over-speeded, or when strained or shocked while in motion within the limits prescribed by the makers, sometimes burst with great violence and spread death and serious injury in the path of their flight. Various methods for confining the wheel fragments to the machine casing, or at least rendering their velocity harmless, have been worked out, and a few are shown in the illustrations. In all of them ample side clearance between the wheel and its casing is a primary requisite. No. 11 shows the method of safely mounting the wheel and avoiding all initial stress due to wedging, keying and driving it on the spindle. No. 16 is the cone-sided wheel so shaped that fragments due to a fracture starting at the wheel center cannot escape beyond the washer plates. Nos. 14 and 15 show various forms of armoring successfully used to retain fractured wheels on disc and face grinders. No. 12 is especially armored for large wheels subject to shock. It has hinged sides of plate steel and a strong cast-steel front guard also hinged. The guard as a whole can slide parallel to the plane of the wheel to take care of reducing diameter due to wheel wear and the hinged front guard can be dropped to meet the same condition. Wheels have been tested to destruction under all the guards illustrated without projecting fragments. No. 13 is a form of releasing grindstone rest which prevents accidents due to tools catching between the usual fixed rest and the stone.

Durability and Identification of Safeguards.—Safeguards, where at all possible, should be constructed of metal to secure durability. Reinforced steel mesh work is preferred for all but the heaviest machinery. It is superior to guards of opaque material since it permits easy inspection without detaching the safeguard and interferes as little as possible with lighting conditions. In steel mills, foundries and heavy work plants of various descriptions, where the wear and tear of equipment is very great, nothing but strong castings or steel plate work should be used for the majority of the guards. It is the practice of the author to have all safeguards readily distinguished by painting the body of them vermillion and the reinforced edges black. This allows executives to detect at a glance in going through the shops a displaced or defective guard, such parts being often small in area, in inconspicuous places, and liable to be overlooked.

Warning and Caution Notices.—These should be sparingly used and be as brief as possible. They give a possible legal protection from certain kinds of accident damage suits but they are practically worthless in every sense if no attempt is made to enforce them. The supervisory and educational efforts of fully instructed and sympathetic foremen receiving full credit for the safeworking of their respective departments and a few well-considered and enforced regulations prominently displayed in print are far more effective than a long catalog of works rules which few will read and none will remember.

SHOP IMPROVEMENTS AT HUNTINGTON, W. VA.; CHESAPEAKE & OHIO.

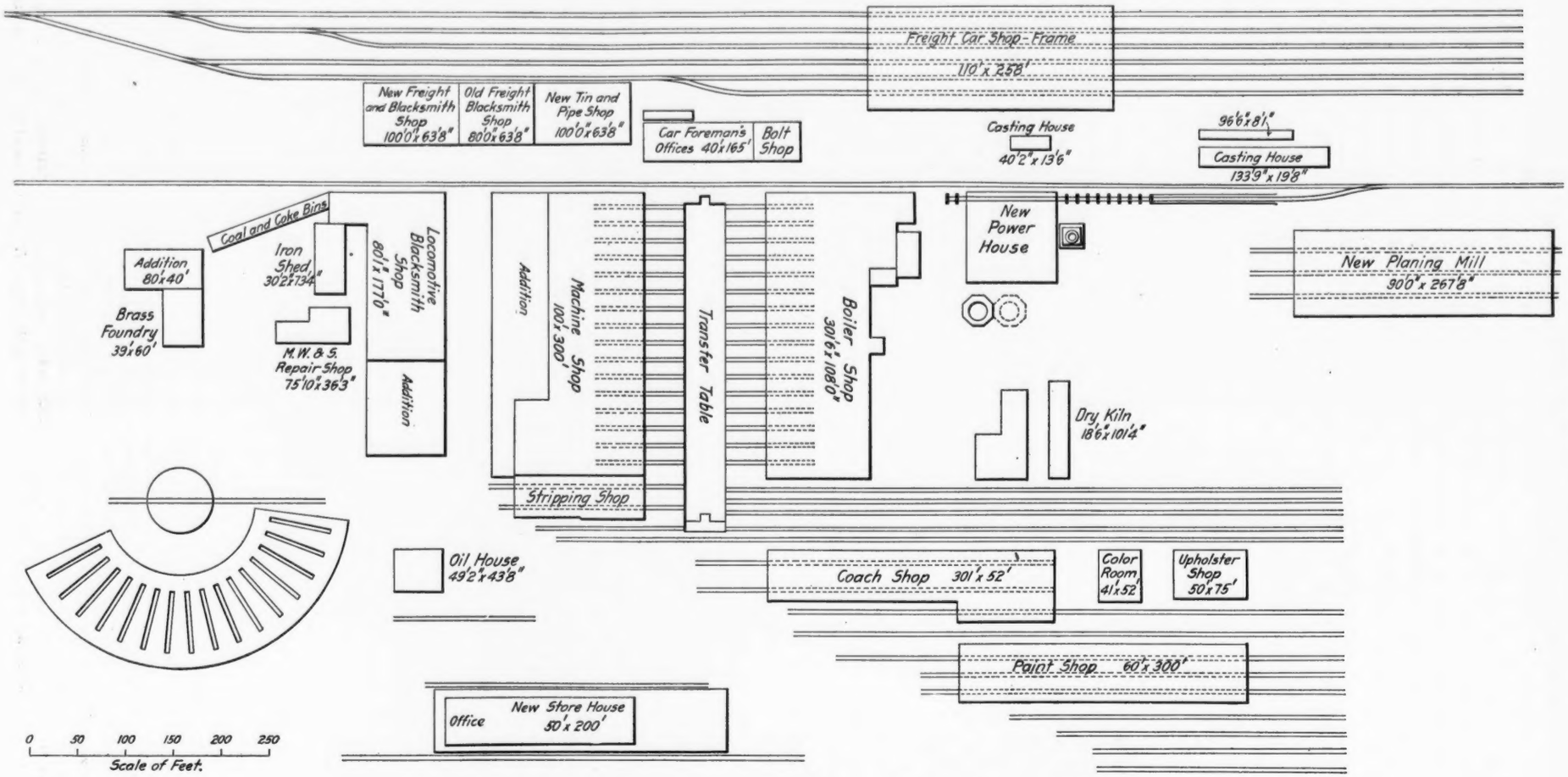
The Huntington, W. Va., shops of the Chesapeake & Ohio were constructed 30 years ago; they were well built but arranged without regard to the necessity for future extensions. Separate steam engines were used for driving each of the line shafts, necessitating the use of several engine rooms and boiler plants. No facilities were provided for lifting the engines by power. The larger number and the greater size of the locomotives to



Locomotive Hoist in Stripping Shop.

be repaired at this point necessitated the enlarging of the shops, and after a careful study it was thought best to utilize the old buildings as far as possible. To do this it was found necessary to install a central power plant, a stripping shop, a planing mill and a storehouse, and to make additions to the machine shop, the boiler shop, the locomotive and freight car blacksmith shops and the brass foundry.

Stripping Shop.—The stripping shop, which is 135 ft. long and 45 ft. wide, is elevated for 50 ft. at one end and is equipped with a hoist which spans the two longitudinal tracks through the building and is used for lifting locomotives from their wheels and placing them on trucks so that they can be pulled on the transfer table and moved into the old erecting shop, at one end of which the stripping shop is placed. When repairs have been completed in the erecting shop, the locomotive is transferred back to the stripping shop, and by means of the hoist is placed on its own driving and truck wheels. Jacking up of the engines for removing and replacing the wheels, a difficult problem with the extremely heavy power recently placed in service, is thus obviated. In the section of the stripping shop that is not served by the hoist are pits where the locomotives can be completed after they have been wheeled without transferring them back to the erect-


Freight Car Shop - Frame
110' x 258'
New Freight and Blacksmith Shop 100'0" x 63'8"
Old Freight Blacksmith Shop 80'0" x 63'8"
New Tin and Pipe Shop 100'0" x 63'8"
Car Foreman's Offices 40'x165'
Bolt Shop
Casting House 40'2" x 13'6"
96'6" x 8'1"
Casting House 133'9" x 19'8"
Coal and Coke Bins
Addition 80'x40'
Iron Shed 30'2" x 134"
Brass Foundry 39'x60'
M.W. & S. Repair Shop 75'10" x 36'3"
Locomotive Blacksmith Shop 80'1" x 177'0"
Addition
Addition
Machine Shop 100' x 300'
Transfer Table
Boiler Shop 30'6" x 108'0"
New Power House
New Planing Mill 90'0" x 267'8"
Dry Kiln 18'6" x 101'4"
Stripping Shop
Oil House 49'2" x 43'8"
Coach Shop 301' x 52'
Color Room 41' x 52'
Upholster Shop 50' x 75'
Paint Shop 60' x 300'
Office
New Store House 50' x 200'
0 50 100 150 200 250
Scale of Feet.

General Arrangement of the Huntington, W. Va., Shops of the Chesapeake & Ohio.

Additions have been made to the old machine shop, the locomotive blacksmith shop, the brass foundry and the old freight car blacksmith shop. The building formerly used for a boiler shop and a planing mill is now used entirely for boiler shop purposes. New buildings have been added for the planing mill, storehouse and power plant. An addition to the machine and erecting shop is used as a stripping shop.

ing shop. It was found necessary to change the drive of the old transfer table from a pair of air engines to an electric drive. Current for the motor is supplied from three overhead trolley wires; two mechanical speed changes are provided to prevent overloading the motor when starting or when moving unusually heavy loads. It is said that the introduction of the stripping shop has assisted in doubling the output of the erecting shop and has materially reduced the cost of locomotive repairs.

Machine Shop.—To provide for the additional machine tools that it was necessary to install, an extension, 300 ft. long and 60 ft. wide, with brick walls, steel roof trusses and skylights in the roof, was built along the wall of the old machine shop. As it was necessary to build only one longitudinal wall, the cost per unit of floor space was low.

Boiler Shop.—The boiler shop was formerly contained in a building, one-half of which was used as a planing mill. The

Cooling Tower and Partial View of Power House.

planing mill was removed to a new building, allowing the old one to be used entirely for boiler repairs. The old equipment was re-arranged and a number of new tools were provided, the most important of which were a sectional flanging press with an extra large flanging and annealing furnace for firebox work; an accumulator and hydraulic pump operating at 1,500 lbs. per square inch to supply power for the press, and with sufficient capacity for the future installation of a hydraulic riveter; an outfit of staybolt machinery for the manufacture of staybolts; a horizontal flange punch; bevel shear; flue sheet and mud-ring drill; extra heavy punching and shearing machines with 60-in. throats; stake riveter; staybolt breaker, etc. An electrically operated five-ton walking gib crane, with a 25-ft. radius, operates longitudinally through the shop. It is used for carrying material from the machine to the erecting side of the shop. An extension to this building, that was formerly used as a power plant, has been converted into a flue shop, and another small addition has been built alongside for the flue rattlers.

Locomotive Blacksmith Shop.—An addition, 100 ft. x 80 ft., has been made to the blacksmith shop, increasing the floor area about 50 per cent. The equipment has been rearranged, the steam hammers being placed in the center of the shop, with a row of double forges on one side and the bolt and forging machinery on the other side. The heavy work and slabbing is done under a 5,000-lb. steam hammer, near which is a large furnace for heating the scrap and extra heavy forgings. An open frame hammer for making repairs to locomotive frames is placed in one corner. The steam hammers, furnaces and many of the forges are served by gib cranes.

Brass Foundry.—The capacity of the brass foundry has been increased by an addition 80 ft. x 40 ft. It is of wood construction to match the old building. To reduce the cost of the output to a minimum, an automatic molding machine, a crude oil brass furnace, sprue cutter, wire cutter, new tumbling barrel, magnetic separator, and a ladle heater have been installed.

Planing Mill.—A substantial two-story fireproof structure, 268 ft. x 90 ft. and having brick walls, steel roof trusses and a concrete slab roof, was erected for planing mill purposes. The first floor is a concrete slab and has two standard gage longitudinal tracks and a transverse track for transporting material. The second floor is made of hollow tile and reinforced concrete and is supported by the side walls and steel columns extending through the center of the shop. The second story is used as a cabinet and pattern shop and for the repair of cabs, hand cars, etc.

The machinery is arranged in groups and is driven by induction type electric motors; the two large planers have individual motors. The planing mill is parallel to the yard tracks instead of at right angles as formerly, making it more convenient for handling the material from the mill to the repair tracks and the passenger car shop. It is located about half way between the lumber yard and the freight car repair tracks.

Freight Car Blacksmith Shop.—Brick structures, 100 ft. x 64 ft., with wooden roof trusses, have been placed at each end of the old freight car blacksmith shop. One of these is used for smith shop purposes and the other as a tin and pipe shop. The equipment in the blacksmith shop was rearranged and several machines were added, including a No. 9 Pullman type bulldozer, a large furnace for straightening steel car material, bulldozers, power hammers, rivet machines and an eyebolt machine.

Storehouse.—The space occupied by the old storehouse was badly needed for other purposes and a new and thoroughly modern storehouse and office building was placed opposite one end of the machine and erecting shop and near the coach shop. It is a two-story brick building, 200 ft. x 50 ft. At the end used for office purposes a third story, 50 ft. long, has been added. A platform 8 ft. wide has been placed along three sides of the building; on the fourth side it has been extended 96 ft., this part being used for the storage of castings and heavy forgings. The building is equipped with an electrically operated freight elevator.

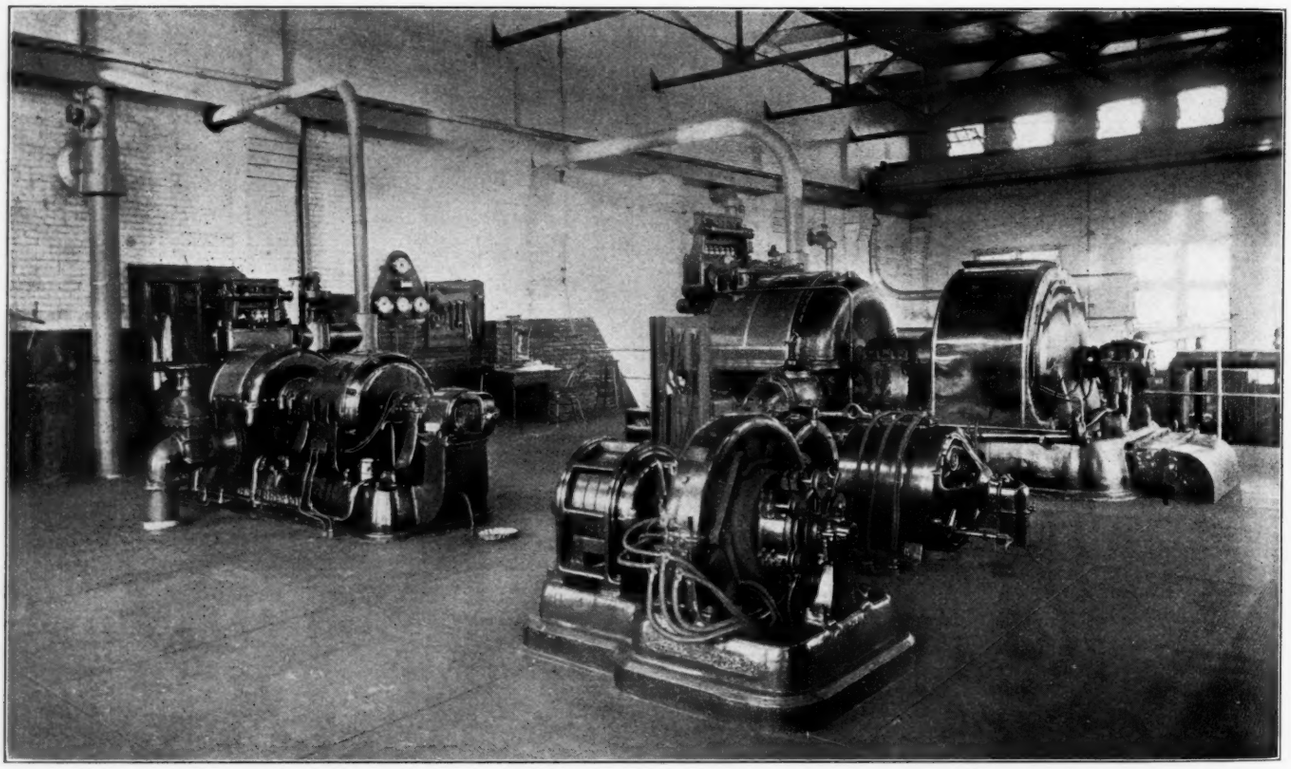
Power Plant.—The arrangement of the power-house is unique. The boiler room floor is approximately at the ground level, while that for the air compressors is slightly higher. The floor of the room in which the turbines are installed is 6 ft. above the air compressor floor, and underneath one-half of it is a basement 6 ft. deep. As the air compressors are run non-condensing, there is no need of having a basement under them, and the cost of the installation was considerably reduced by having them at the ground level. The large turbines require space underneath them for condensers, and part of this space is also utilized for feed pumps, return pumps, exhaust header, etc. The power-house, which is 80 ft. x 93 ft., is fireproof throughout, having brick walls on concrete foundations, steel roof trusses, and a concrete slab roof. A 7½-ton hand-power crane is installed in

the turbine room. A coal bin underneath an elevated track with a trestle approach is placed alongside the power-house. There is also an overhead ash bin with an electric hoist and a bucket for elevating ashes. The bin is fitted with a spout for loading the ashes into cars by gravity.

The power-house equipment includes one 750-k.v.a. General Electric turbine set operating condensing; one 125-k.v.a. General Electric turbine set operating non-condensing; the current used is three-phase, 60-cycle, 440 volts. One turbine and a motor-driven exciter are provided for the alternating current generators. Space is left for the future installation of a 750-k.v.a. turbine. The boiler equipment consists of five 271 h. p. Stirling water tube boilers operating at 150 lbs. pressure. The furnaces of these boilers are arranged to burn slack coal, and the boilers are ordinarily operated at a 50 per cent. overload. The chimney, which is 200 ft. high by 7 ft. 6 in. in diameter, is constructed of hollow tile and reinforced concrete. The old stack, which was heavily constructed and too small for any possibility of salvage, was pulled down by the use of a locomotive, a rather unusual but inexpensive method. Two air compressors taken from the old power-house were installed in the new one.

The supply of water available for condenser purposes was small and it was necessary to erect a cooling tower having a steel shell 90 ft. high and 20 ft. in diameter. Thirty feet at the lower part of the shell contains a grillage of cypress planking having a surface of about 30,000 sq. ft. The water after being used to condense the steam from the turbine is pumped from the condenser and spread over the grillage by a system of perforated pipes. As it falls in thin filaments over the surface of the grillage it is sufficiently cooled by contact with the air to be again used in the condenser. The movement of air within the tower is accomplished by natural draft. The condenser is of the Westinghouse Le Blanc type, driven by an induction motor directly connected to a shaft on which are mounted both rotary circulating and air pumps. On one of the hottest days last summer, with the thermometer 95 deg. in the shade, a vacuum of 26 in. was easily maintained throughout the day. The installation of the new power plant has resulted in a decrease of 50 per cent. in the coal consumption, with an increase of over 100 per cent. in the amount of power supplied.

General.—The rebuilding of these shops has resulted in an increase in the locomotive output of approximately 100 per cent., with a material decrease in the cost of repairs per locomotive and an increase of about 50 per cent. in the planing mill output, with no increase in the cost of labor. The work of extending the shops was carried on under the direction of J. F. Walsh, general superintendent motive power; C. H. Terrill, superintendent motive power; T. M. Ramsdell, master car builder; W. S. Buckley, master mechanic, and was designed and executed by Westinghouse, Church, Kerr & Co., New York.



Turbine Room in Power House, Huntington Shops; Chesapeake & Ohio.

FOREIGN RAILWAY NOTES.

The Hungarian minister, who has had charge of the state railways declares that they can no longer make both ends meet with the present rates. It will be a very unpopular thing to raise them, but it must be done. Formerly the cost per ton per mile was 0.73 cent, while the income was 1.32 cents. Now the cost has gone up to 0.88 cent, while the income has decreased. An increase of 8 per cent. in freight rates, which has been proposed, will not be enough.

The many nationalities included in Austria,—Bohemians, Poles, Ruthenians, etc.—are in many parts pretty well mixed with Germans and with each other. Several have secured laws providing that in their provinces their own language shall be used by the railway men, as well as German, and that all names on signs and in time tables, etc., shall be so expressed. Further, there is apt to be a good deal of friction if the larger number of the officials with whom they come in contact are not of their race. The new Austrian minister of railways, himself a Pole, says that in these districts of mixed languages the situation of the officials is often insufferable. The years which one spends there can only be called years of conflict. They are continually appealing to their superiors to transfer them to some other district.

General News Section.

Officers of the New York Central say that they have filled the places of the boilermakers who struck on February 21.

President Taft has awarded a railway life-saving medal to Miss Nettie Caskey, of Fairmount, Ind., who at the risk of her life saved a little child from being run over by a train.

The Upper House of the legislature of Oklahoma has adopted, without debate, a resolution designed to repeal the provision in the constitution of that state which forbids the sale of a domestic railway to a foreign company.

A special train, consisting of an engine and three cars, carrying officers of the road, was run over the Pennsylvania from Altoona to Philadelphia, 235.1 miles, on February 28, in 3 hours, 29 minutes, or at the rate of 67.5 miles an hour.

According to a press despatch from Syracuse, N. Y., 248 railway mail clerks have formed an association, and have affiliated themselves with the American Federation of Labor. This revolutionary action is taken, we are told, because the clerks have been denied the right of appeal to the higher officers of the post office department.

Officers of the Pennsylvania have denied reports published last week, following the decisions of the Interstate Commerce Commission in the freight rate cases, that important retrenchment orders had been given. The shops at Altoona were closed one day, February 25, because of the necessity of keeping the expenditures for the month within a certain fixed appropriation.

According to a Buffalo paper, 25 bill-clerks in the freight office of the Pennsylvania in that city, struck and left their work last week Friday, their grievance being that a new division freight agent had prescribed unreasonable regulations. The principal thing objected to seems to have been a rule making each bill-clerk responsible for losses of money due to errors in billing.

The Barge Canal Terminal Commission of the state of New York has submitted to the legislature its final report. It recommends that the state appropriate the sum of $16,500,000 to be spent for the construction and equipment of public terminal facilities for the canal, such sum to cover the purchase of necessary lands where such lands are now not publicly owned.

The express car of a train of the St. Louis, Iron Mountain & Southern was robbed, last Tuesday night, about 8 o'clock, in the city of St. Louis, the robbers having boarded the train at Broadway station and walked through the passenger coaches to the express car. They are said to have secured about $2,000. After binding the messenger hand and foot, they jumped off the train as it approached Tower Grove station.

According to a press despatch from El Paso, railway traffic in Mexico south of Chihuahua is tied up in many places, on account of the destruction of bridges and tracks by insurgents. The National lines are running only second-class coaches and are using only the oldest locomotives. In the northern part of Mexico, railway traffic, which has been interrupted for a month because of insurrection, is somewhat improved.

The Western Union Telegraph Company has so largely increased its business by the introduction of low rates for night letters, that it announces that it will accept "day letters" also at reduced rates; but these will be transmitted only when the wires are clear of regular day messages. For night letters the rate for 50 words is the same as for a regular ten-word day message; for day letters the rate will be 50 per cent. higher than for night letters.

The Chicago, Milwaukee & St. Paul has dismissed a large number of shop employees and some men in the track and other departments. This news was given out the day following the announcement of the Interstate Commerce Commission's decisions in the freight rate cases, the explanation given being that the officers of the road feared that the decision would cause a slackening of business in the Northwest. On Thursday, before the rate decision was announced, the St. Paul, it is said, had offered its telegraphers an increase of 6 per cent. in wages, but on Friday it was withdrawn.

The War Department has denied the applications for extension of the piers in the North river, New York City, which applications were made because of the need for providing dock room for the White Star Line's new steamships, which are about 100 ft. longer than the longest New York dock. The denial is based on the recommendation of the Harbor Line Board, and applies not only to the application of the steamship companies, which wanted to extend their piers 100 ft. into the river on the New York side, but also to that of the Riparian Commission of New Jersey, which desired a general extension between Fifteenth street, Hoboken, and Weehawken Cove. The new ships are to be put in commission within a few months. It is said that they could find convenient docks at New London or Boston; and Mr. Peters of the Long Island Railroad says that a pier to accommodate them could be built at Montauk Point by June.

Boiler Inspector Appointed.

President Taft has nominated for chief inspector of locomotive boilers, under the law recently passed, John F. Ensign, of Colorado; and for assistant chief inspectors Frank McManamy of Oregon and G. P. Robinson of New York. Mr. Ensign is a member of the Brotherhood of Locomotive Engineers, and Mr. McManamy, of the Firemen's Brotherhood, and both are now safety appliance inspectors of the Interstate Commission. Mr. Robinson is chief inspector of locomotive boilers for the New York State Public Service Commission, second district. The good results of the New York state inspection have recently been noticed in the *Railway Age Gazette.*

Rail Production in 1910.

Statistics prepared by the American Iron and Steel Association show that the total rail production of all kinds in the United States in 1910 amounted to 3,634,029 tons, as compared with 3,023,845 tons in 1909. The increase over 1909 was 610,184 tons, or over 20 per cent. Rail production in this country reached its high water mark in 1906, when the total tonnage was 3,977,887. Only 172,856 tons of rails were rolled during 1910 from purchased ingots or blooms, crop ends, seconds or renewed or rerolled rails, while 3,460,943 tons were rolled from ingots made by the rail manufacturers. The remaining 230 tons were iron. The rail production, according to weight for the last eleven years, was as follows:

Kinds of rails. Gross tons.	Under 45 lb.	45 lb. and less than 85.	85 lb. and over.	Total. Gross tons.
Bessemer rails	190,455	861,591	865,854	1,917,900
Open hearth rails	31,977	424,381	1,259,541	1,715,899
Iron rails	230	.....	.....	230
Totals for 1910	222,662	1,285,972	2,125,395	3,634,029
Totals for 1909	255,726	1,024,856	1,743,263	3,023,845
Totals for 1908	183,869	687,632	1,049,514	1,921,015
Totals for 1907	295,838	1,569,985	1,767,831	3,633,654
Totals for 1906	284,612	1,749,650	1,943,625	3,977,887
Totals for 1905	228,252	1,601,624	1,546,053	3,375,929
Totals for 1904	291,883	1,320,677	672,151	2,284,711
Totals for 1903	221,262	1,603,088	1,168,127	2,992,477
Totals for 1902	261,887	2,040,884	645,162	2,947,933
Totals for 1901	155,406	2,225,411	493,822	2,874,639
Totals for 1900	157,531	1,626,093	602,058	2,385,682

"Labor" Legislation Galore.

[A general manager quoted in the *Wall Street Journal.*]

Proposed labor legislation, which directly attacks the treasuries of the railways, has never been more voluminous in the legislatures and Congress than at present. This tendency has now assumed alarming proportions. The recent successful conclusion reached in the wage negotiations by the employees has made them arrogant. The ease with which they secured increases in wages ranging from 10 per cent. to 100 per cent. has convinced them that they can safely go to any lengths. The result has been a flood of bills introduced all over the country, which although labeled "for the public service," are nothing more than efforts by employees to secure for themselves shorter hours, less work and more pay. In this the employees are aided by politicians who are willing to lend their aid to these measures in return for the labor vote.

In Ohio, Indiana, Illinois, Nebraska and New York, we are

compelled constantly to fight this adverse legislation. The Clearance Bill now before Congress, which, if passed, will cost the railways over $440,000,000, is but one example of the extremes to which this labor legislation has reached. The full crew bill in Indiana is another. An extra brakeman has to be carried on every train. It will be hard to find any general manager who considers this anything but a useless expense.

In Indiana, a bill has just been introduced into the legislature providing that a railway cannot employ a man as a switchman until he has had a year's experience. The bill does not say what experience is necessary. This bill, instead of being referred to the regular Committee on Transportation, was referred to a special committee made up wholly of labor's representatives in the legislature. Although presumably for the public safety, if passed it will make it impossible to employ new men in case of a strike. The penalty provided is $1,000 fine for each offence. When this was objected to by a railway representative at the hearing, it was proposed to make the penalty $500 fine and five months' imprisonment.

In Ohio a bill has been introduced requiring that all cabooses shall be 24 ft. long. This will mean that our road alone would have to buy 1,000 new cabooses.

The situation has reverted into one where the railways are compelled to constantly fight their own employees. Every labor organization maintains a lobby at the state capitals and at Washington. They have their own representatives in the law-making bodies. Candidates are pledged before election, nor can they ignore their pledges after. Everybody can play politics but the railways, and there is no single interest that has more legislation directed against it than the railway interest.

Last week the Supreme Court upheld the constitutionality of the Arkansas full crew law. This effectually forestalls carrying any further the fight against the Indiana law. We can now expect that similar bills pending in the state degislatures of New York, New Jersey, Ohio and Illinois will be passed. Eventually it will mean that all of the states will adopt such laws.

Extension of Time on Safety Appliances.

Following the hearing by the Interstate Commerce Commission at Washington, February 27, it was announced that the commission would soon issue an order extending the time within which railways must comply with certain provisions of the law of April 14, 1910, requiring uniform running-boards, handholds, hand-brakes and other safety appliances. After conference with representatives of the railways and of the employees' brotherhoods, a form of order was drawn up providing that the time for complying with the law respecting brakes, ladder-clearances and certain other features of freight cars, should be extended for five years from July 1, 1911; the time to make similar changes on passenger cars for three years from the same date; on road locomotives two years, and on switching locomotives one year. The bill now before Congress, appropriating money for the expenses of the Interstate Commerce Commission for the next fiscal year, contains a clause empowering the commission to postpone the date of compliance with this law, not only as regards old cars but also as regards cars put in service up to July 1, 1911. As the law was passed, originally, the commission could not extend the time limit except in relation to cars which were in service April 14, 1910.

Railway Storekeepers' Association.

The eighth annual convention of the Railway Storekeepers' Association will be held at the Hotel Pfister in Milwaukee, Wis., May 22-24. The subjects to be discussed are as follows: Regular subjects: The Need of Standard Material Classification and Disbursements in Order to Intelligently Compare the Work of the Various Supply Departments and the Relative Stock of Material Which They Maintain; The Railway as a Manufacturer; The Standardization of Tinware; The Standardization of Storehouses, Oil Houses, Scrap Docks, Supply Cars, etc.; Timber Treating. Topical subjects: Stock Upkeep and Stock Reduction; Outline of Methods in Handling Navy Department Stores; Return of Cement Sacks, Carboys, Drums, etc.; Standard Railroad Electric Light Fixtures. Committee reports will be received at the convention from the committee on Recommended Practice; Piece Work; Scrap Classification; Accounting; and Membership.

Engineers' Club of Kansas City.

The Engineers' Club of Kansas City, Kansas City, Mo., was organized in January, 1911, and now has a membership of 100. The club was established for the purpose of bringing together representatives of the engineering profession to engage in general discussions of matters of professional interest, and to cultivate friendly social relations. The first dinner meeting of the club was held on February 17, and was followed by an illustrated talk on the Detroit river tunnel by W. S. Kinnear, president of the Kansas City Terminal Company, and formerly chief engineer of the Detroit River Tunnel Company. The officers of the club are as follows: President, John Lyle Harrington; vice-president, F. W. Pratt; secretary, A. Hurlbut. The headquarters are in the rooms of the University Club of Kansas City.

American Society of Mechanical Engineers.

The sixty-third meeting of the American Society of Mechanical Engineers will be held in Pittsburgh, Pa., on May 30 to June 2. The executive committee, consisting of E. M. Herr, chairman; George Mesta, J. M. Tate, Jr., Chester Albree, D. F. Crawford, Morris Knowles and Elmer K. Hiles, secretary, will have charge of these meetings. An attendance of 300 or 400 is expected. There will be professional sessions when papers will be read and discussed. There will also be inspection trips through the leading local industrial establishments.

American Institute of Consulting Engineers.

At a meeting of the council of the American Institute of Consulting Engineers New York on February 24, it was decided to oppose all the bills now pending in the New York legislature to license civil engineers. The president, Mr. Boller, and the committee on legislation of the institute were instructed to attend the hearings on these bills at Albany, and to use all legitimate means to prevent their passage; also to co-operate with other engineering bodies having a like object in view.

Central Railway Club.

At the regular meeting of the Central Railway Club at Buffalo, N. Y., March 10, John P. Kelly will present a paper on the Influence of Gravity on Trains Descending Grades, and Brake Power Necessary for Safe Control. The standing committee on rules of interchange will also present its report of recommendations for the consideration of the Master Car Builders' Association.

American Society of Civil Engineers.

At the meeting of the American Society of Civil Engineers, held on March 1, a paper by Albert R. Raymer, M. Am. Soc. C. E., entitled the Pittsburgh & Lake Erie Railroad Cantilever Bridge over the Ohio River at Beaver, Pa., was presented for discussion.

Canadian Society of Civil Engineers.

At a meeting of the mechanical section of the Canadian Society of Civil Engineers, March 2, a paper by Col. Alex. Bertram on Recent Advances in Machine Tool Construction, was read by the author and illustrated by lantern slides.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass.; annual convention, May 23-26, Chicago.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.—A. G. Thomason, Scranton, Pa.; next meeting, June 22, 1911, Niagara Falls, N. Y.

AMERICAN ASSOCIATION OF GENERAL PASSENGER AND TICKET AGENTS.—C. M. Burt, Boston, Mass.; next meeting, St. Paul, Minn., 1911.

AMERICAN ASSOCIATION OF LOCAL FREIGHT AGENTS.—R. O. Wells, East St. Louis, Mo.

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.—O. G. Fetter, Carew building, Cincinnati, Ohio; 3d Friday of March and September.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.—H. C. Donecker, 29 W. 39th St., New York.

AMERICAN RAILWAY ASSOCIATION.—W. F. Allen, 24 Park Place, New York; May 17, New York.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—C. A. Lichty, C. & N. W., Chicago; next meeting, March 22, Chicago.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.—E. H. Fritch, Monadnock building, Chicago; March 21-23, 1911, Chicago.

AMERICAN RAILWAY INDUSTRIAL ASSOCIATION.—G. L. Stewart, St. L. S. W. Ry., St. Louis, Mo.; May 9, 1911, Detroit, Mich.
AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago; June 14-16, 1911, Atlantic City, N. J.
AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—O. T. Harroun, Bloomington, Ill.
AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.
AMERICAN SOCIETY OF CIVIL ENGINEERS.—C. W. Hunt, 220 W. 57th St., New York; 1st and 3d Wednesdays, except June and August, New York.
AMERICAN SOCIETY OF ENGINEERING CONTRACTORS.—D. J. Haner, 13 Park Row, New York; 3d Tuesday of each month, New York.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 39th St., New York; next convention, May 30-June 2, Pittsburgh, Pa.
ASSOCIATION OF AMERICAN RAILWAY ACCOUNTING OFFICERS.—C. G. Phillips, 143 Dearborn St., Chicago; April 26, 1911, New Orleans, La.
ASSOCIATION OF RAILWAY CLAIM AGENTS.—J. R. McSherry, C. & E. I., Chicago; May, 1911, Montreal, Can.
ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Jos. A. Andreucetti, C. & N. W. Ry., Chicago; semi-annual, June, Washington, D. C.; annual, November, Chicago.
ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—P. W. Drew, 135 Adams St., Chicago; June 19, 1911, Boston, Mass.
ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 24 Park Place, New York; June 20-21, 1911, Cape May City, N. J.
CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tuesday in month, except June, July and Aug., Montreal.
CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, 413 Dorchester St., Montreal, Que.; Thursdays, Montreal.
CAR FOREMAN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 North 50th Court, Chicago; 2d Monday in month; annual, October 9, Chicago.
CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York; 2d Friday in January, March, May, Sept. and Nov.; Buffalo, N. Y.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—D. F. Jurgensen, 116 Winter St., St. Paul, Minn.; 2d Monday, except June, July and Aug., St. Paul.
ENGINEERS' SOCIETY OF PENNSYLVANIA.—E. R. Dasher, Box 704, Harrisburg, Pa.; 1st Monday after 2d Saturday, Harrisburg, Pa.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—E. K. Hiles, 803 Fulton building, Pittsburgh; 1st and 3d Tuesday, Pittsburgh, Pa.
FREIGHT CLAIM ASSOCIATION.—Waren P. Taylor, Richmond, Va.; June 21, St. Paul, Minn.
GENERAL SUPERINTENDENTS' ASSOCIATION OF CHICAGO.—H. D. Judson, 209 East Adams St., Chicago; Wednesday preceding 3d Thursday, Chicago; annual, July 29, Chicago.
INDIANAPOLIS RAILWAY AND MECHANICAL CLUB.—B. S. Downey, C., H. & D., Indianapolis, Ind.
INTERNATIONAL MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York; next convention, Omaha, Neb.
INTERNATIONAL RAILWAY CONGRESS.—Executive Committee, rue de Louvain, 11 Brussels; 1915, Berlin.
INTERNATIONAL RAILWAY FUEL ASSOCIATION.—D. B. Sebastian, La Salle St. Station, Chicago; May 15-18, 1911, Chattanooga, Tenn.
INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—L. H. Bryan, D. & I. R. Ry., Two Harbors, Minn.; next convention July 25-27, Chicago.
INTERNATIONAL RAILWAY MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, Lima, Ohio.
IOWA RAILWAY CLUB.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month, except July and August, Des Moines.
MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago; June 19-21, 1911, Atlantic City, N. J.
MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION, OF UNITED STATES AND CANADA.—A. P. Dane, B. & M., Reading, Mass.; Sept. 12-15, 1911, Atlantic City, N. J.
NEW ENGLAND RAILROAD CLUB.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tuesday in month, except June, July, Aug. and Sept., Boston.
NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August, New York.
NORTHERN RAILWAY CLUB.—C. L. Kennedy, C., M. & St. P.; 4th Saturday, Richmond, Va.; 20th annual, June 21, 1911, St. Paul, Minn.
OMAHA RAILWAY CLUB.—A. H. Christiansen, Barker Blk.; second Wed.
RAILWAY CLUB OF KANSAS CITY.—C. Manlove, 1008 Walnut St., Kansas City, Mo.; 3d Friday in month, Kansas City.
RAILWAY CLUB OF PITTSBURGH.—C. W. Alleman, P. & L. E., Pittsburgh, Pa.; 4th Friday in month, except June, July and August, Pittsburgh.
RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, Bethlehem, Pa.; March 20, Chicago; annual, Oct. 10, Colorado Springs, Colo.
RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio; annual, May 22-24, 1911, Milwaukee, Wis.
RICHMOND RAILROAD CLUB.—F. O. Robinson, Richmond, Va.; 2d Monday, except June, July and August.
ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.; Oct., 1911, St. Louis.
ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug., St. Louis; annual, Oct. 20, Atlanta.
SOCIETY OF RAILWAY FINANCIAL OFFICERS.—C. Nyquist, La Salle St. Station, Chicago; Sept. 12-14, St. Paul, Minn.
SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—E. W. Sandwich, A. & W. P. Ry., Montgomery, Ala.; semi-annual, April 20, Atlanta, Ga.
SOUTHERN & SOUTHWESTERN RAILWAY CLUB.—A. J. Merrill, Prudential bldg., Atlanta, Ga.; 3d Thurs., Jan., April, August and Nov., Atlanta.
TOLEDO TRANSPORTATION CLUB.—L. G. Macomber, Woolson Spice Co., Toledo, Ohio; 1st Saturday; annual, May 6, 1911, Toledo.
TRAFFIC CLUB OF CHICAGO.—Guy S. McCabe, La Salle Hotel, Chicago; meetings monthly, Chicago.
TRAFFIC CLUB OF NEW YORK.—C. A. Swope, 290 Broadway, New York; last Tuesday in month, except June, July and August, New York.
TRAFFIC CLUB OF PITTSBURGH.—T. J. Walters, Oliver building, Pittsburgh, Pa.; meetings monthly, Pittsburgh.
TRAIN DESPATCHERS' ASSOCIATION OF AMERICA.—J. F. Mackie, 7042 Stewart Ave., Chicago; annual, June 20, 1911, Baltimore, Md.
TRANSPORTATION CLUB OF BUFFALO.—J. M. Sells, Buffalo; 1st Sat. after 1st Wed.; annual, Dec. 11, 1911.
TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y.; annual, August, 1911, Chicago.
WESTERN CANADA RAILWAY CLUB.—W. H. Rosevear, P. O. Box 1707, Winnipeg, Man.; 2d Monday, except June, July and August; annual, May 8, Winnipeg.
WESTERN RAILWAY CLUB.—J. W. Taylor, Old Colony building, Chicago; 3d Tuesday of each month, except June, July and August.
WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, 1735 Monadnock Block, Chicago; 1st Wednesday in month except July and August, Chicago.
WOOD PRESERVERS' ASSOCIATION.—F. J. Angier, First National Bank bldg., Chicago.

Traffic News.

An agricultural instruction train is to be run over the standard gauge lines of the Denver & Rio Grande in Colorado, the railway company co-operating with the Colorado Agricultural College.

The Los Angeles Traffic Club, Los Angeles, Cal., is to be reorganized, and representatives of shippers will be admitted to membership. Hitherto, the club has been composed wholly of railway men. The president of the organization is E. S. Blair, traveling freight agent of the Missouri Pacific.

The New York State Barge Canal Terminal Commission has made its report to the legislature. It covers the location and the estimated expense of the terminals recommended, the character of facilities necessary for the trans-shipment of freight and maps indicating the places in the several cities in which the terminals are recommended. There is a full description of prominent European waterways and terminals, and an extended compilation of the port dues and charges at leading seaports and inland harbors.

A press despatch from Decatur, Ala., says that the suits which have been filed in the courts against the Southern Railway and the Louisville & Nashville, in connection with fraudulent bills of lading on cotten sent to Europe, number 37, and the aggregate damages demanded will amount to $2,000,000. These suits have been transferred to the Federal court, and will be tried at Huntsville in April. The plaintiffs are English and German creditors of Knight, Yancey & Co., the cotton firm which failed for about $6,000,000.

At a largely attended meeting at the Western Trunk Line offices in Chicago on Wednesday, it was decided to make no appeal from the recent decision of the Interstate Commerce Commission denying the roads the right to increase freight rates. It was argued that if the roads comply with the decree without objection, there will be an opportunity at a later date to submit advances on certain rates, some of which may meet with favor.

The legal officers of prominent roads met in New York and considered the commission's decision, but no action was taken.

The Southern Railway will next week run an agricultural educational train over the lines of its Richmond division, the Virginia State Department of Agriculture and Immigration co-operating with the officers of the railway. A similar train is to be run in Kentucky in co-operation with the Department of Agriculture and the College of Agriculture of that state. In connection with other railways the Southern is furnishing free of charge a train with which the State College of Agriculture of Georgia is making a 47-day tour of that state. This large expense is borne by the railways in the belief that their interests are identical with those of the farmers.

Southern Commercial Congress.

The first session of the Southern Commercial Congress which is to be held at Atlanta, Ga., meets March 8. The congress is the guest of the Atlanta Chamber of Commerce. The program gives the names of a large number of men who are to speak at the first session. Among others who will give external views of the South are: James Wilson, secretary of the Department of Agriculture, who will speak on the agricultural obligations of the South; Judge Gary, who is invited to speak on the manufacturing obligations of the South; George Westinghouse, who will speak on electricity in the development of the South, and many others. Chairman Clements of the Interstate Commerce Commission, has been invited to speak on public service corporations; President Hadley, on the valuation of stocks and bonds, and Charles Hansel, on the valuation of railway property.

Financial Results of Mexican Railways.

Since the National Railways of Mexico do not report to the Interstate Commerce Commission their earnings are not included in our table of monthly earnings. An officer of the railways has furnished figures regarding the financial results of the operation of these lines during the six months ended January 1, 1911. The lines whose results are included in the statement are the

National Railways, Interoceanic Railway, Mexican Southern and Texas-Mexican Railways, having a mileage of 7,385 miles. The Veracruz & Isthmus is not included.

Gross earnings during this period were $36,561,586 as compared with $32,621,387 in the same months of 1909, an increase of 12 per cent.; operating expenses $21,715,718, as compared with $20,423,440 in 1909, an increase of 6 per cent., and net earnings $14,845,868, as compared with $12,197,946 in 1909, an increase of 21 per cent., all in Mexican money. The estimated earnings of the National Railways of Mexico alone for the month of January, 1911, were $6,150,970, an increase over the same month of 1910 of $342,743, or 5 per cent., and for February, $1,350,267, an increase of $157,007, or 13 per cent.

In transmitting the above statement the officer in question said: "In view of the stories you have heard in regard to revolutionary conditions in this country, the above statement of our earnings is the best refutation of them; at least they show the results of the revolutionary efforts are very local, being confined to the state of Chihuahua, and not affecting business generally."

Car Surpluses and Shortages.

Arthur Hale, chairman of the committee on relations between railways of the American Railway Association in presenting statistical bulletin No. 89-A, giving a summary of car shortages and surpluses by groups from October 27, 1909, to February 15, 1911, says:

"There was a further increase in the surplus of 19,254 cars, making a total for this report of 175,609. There was practically no change in the box car surplus, the increase being entirely in coal and miscellaneous cars. The surplus at present is about three times as large as for the same period last year, the greatest difference being in coal cars, of which class there was a very small excess in February, 1910. It is probable that this difference is due less to a reduced traffic than to the comparative freedom from congestion which has been the result of favorable weather conditions existing during the present winter."

The accompanying table gives surpluses and shortages by groups for the last period covered by the report and the charts give biweekly totals for 1907, 1908, 1909, 1910 and 1911.

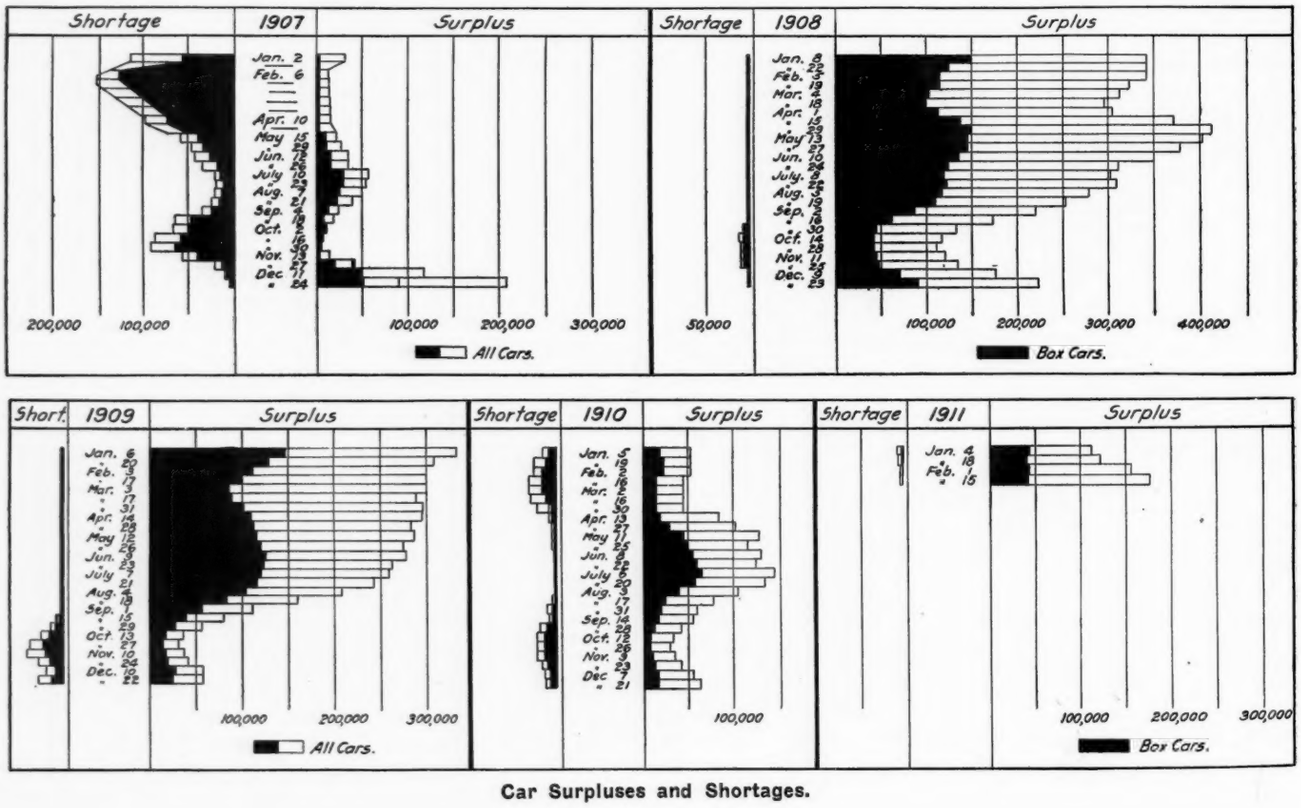
Work of the Railway Ticket Protective Bureau.

The Railway Ticket Protective Bureau has issued a statement regarding its work since November 12, 1909. Boston has been entirely cleared of the ticket scalping evil. Owing to conditions beyond the control of the officers of the bureau, one ticket scalping office is being operated in New York City. A temporary injunction prohibiting the ticket brokerage business at Syracuse, N. Y., has been made permanent. In several instances, brokers

CAR SURPLUSES AND SHORTAGES.

Date.	No. of roads.	Surpluses: Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.	Shortages: Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.
Group *1.—February 15, 1911	8	253	1,377	3,068	179	4,877	0	0	50	8	58
" 2.— " 15, 1911	23	4,186	575	19,266	8,964	32,991	8	0	2	16	26
" 3.— " 15, 1911	24	5,706	1,603	39,064	5,385	51,758	0	100	100	16	216
" 4.— " 15, 1911	10	3,680	91	4,208	1,918	9,897	0	193	0	0	193
" 5.— " 15, 1911	17	1,958	481	5,750	994	9,183	0	45	50	0	95
" 6.— " 15, 1911	22	8,836	1,175	4,729	5,745	20,485	73	8	34	167	282
" 7.— " 15, 1911	3	433	96	1,271	822	2,622	0	0	0	0	0
" 8.— " 15, 1911	15	6,479	770	5,596	3,028	15,873	0	0	0	0	0
" 9.— " 15, 1911	13	3,301	377	345	784	4,807	0	0	0	7	7
" 10.— " 15, 1911	21	5.460	2,780	3,364	9,996	21,600	2	0	0	4	6
" 11.— " 15, 1911	6	57	668	42	749	1,516	727	0	0	332	1,059
Total	162	40,349	9,993	86,703	38,564	175,609	810	346	236	550	1,942

*Group 1 is composed of New England lines; Group 2—New York, New Jersey, Delaware, Maryland, and Eastern Pennsylvania lines; Group 3—Ohio, Indiana, Michigan and Western Pennsylvania lines; Group 4—West Virginia, Virginia, North and South Carolina lines; Group 5—Kentucky, Tennessee, Mississippi, Alabama, Georgia, and Florida lines; Group 6—Iowa, Illinois, Wisconsin, Minnesota and the Dakotas lines; Group 7—Montana, Wyoming and Nebraska lines; Group 8—Kansas, Colorado, Missouri, Arkansas and Oklahoma lines; Group 9—Texas, Louisiana and New Mexico lines; Group 10—Oregon, Idaho, California and Arizona lines; Group 11—Canadian lines.



Car Surpluses and Shortages.

who formerly operated at Buffalo and Niagara Falls tried to re-establish offices. Evidence was collected under which they were fined from $50 to $250, and this has suppressed the practice there. Scalpers tried to establish offices at Toledo to deal in Sunday excursion tickets, but injunctions prohibiting their operations were secured. Ticket scalping is still being carried on in the vicinity of the union station at Columbus, Ohio, but the bureau will try to secure action either by the courts or the city council that will correct the situation. There are no regular scalping offices maintained in Indianapolis, and with the co-operation of the city's police department and local railway representatives the bureau was able to suppress a traffic in week-end or Sunday excursion tickets which was carried on principally by boys and young men. Injunctions issued by state and federal courts closed all the scalping offices in Detroit. Six brokerage offices were operated in Chicago last summer, four of which were obscurely located in basements and conducted in conjunction with other businesses. Early in the season three were compelled by the bureau to close, and the proprietors of two were prosecuted under the Interstate Commerce act for dealing in railway passes and fined $50 each. Against the other a similar indictment is pending. One conviction for contempt of court, consisting in the violation of an injunction, was secured, and the judgment was suspended by the court on condition that the offender permanently retire from the ticket scalping business. Two other trials for contempt are yet to take place.

Frequent investigations have shown that no open effort has been made to re-establish ticket brokerage at St. Louis, although in some cases live stock passes have been sold. Several scalpers at Kansas City successfully resisted the efforts of the bureau to put them out of business for a long time. After months of patient investigation, however, the bureau was able to lay before the state and municipal authorities proof of the criminal nature of their transactions. As a result, the brokerage offices in the city were closed, and the persons arrested were held for the grand jury. Indictments were obtained and the trials are now in progress.

Decrees issued by the courts at Salt Lake City two years ago closed the regular brokerage offices, but it developed later that hotel clerks, porters, cab drivers and keepers of cigar stands were dealing in returned portions of tourist and excursion tickets. Copies of the injunctional decrees were served on these persons, and with the co-operation of the hotel proprietors scalping was stopped at both Salt Lake City and Ogden. Despite the fact that the bureau has succeeded three times in closing all the brokerage offices in Denver, the business of scalping has, in one form or another, been as often re-established. Most of the scalping has been done in the suburbs of the city. Litigation to put the brokers at this place out of business is already in progress. Last summer two brokerage offices were opened at Los Angeles. The proprietor of one has been twice indicted by the grand jury for violating the law by offering tickets for sale through the mails at less than the lawful published rates. Hearing on the second indictment is now pending.

INTERSTATE COMMERCE COMMISSION.

The commission has suspended until June 28, certain tariffs, on grain, filed by the Chicago, Rock Island & Pacific.

The commission has suspended until September 15, tariffs showing increased rates on coal from West Virginia and Virginia to points on Lake Erie, filed by the Baltimore & Ohio, the Chesapeake & Ohio and the Norfolk & Western.

Reparation Awarded.

Miller & Lux, Inc. v. Southern Pacific et al. Opinion by Commissioner Lane:

Rate collected on shipment of live stock found unreasonable because released valuation was not written in live-stock contract. (20 I. C. C. 129.)

George D. Henry v. Eastern Railway of New Mexico et al. Opinion by Commissioner Meyer:

Rate imposed on shipment of sheep in double-deck cars from Vaughn, N. Mex., to Kansas City, Mo., fed in transit at Pampa, Tex., found to be unreasonable. (20 I. C. C. 171.)

Browne Grain Co. v. Gulf, Colorado & Sante Fe et al. Opinion by the commission:

Rate of 52½ cents per 100 lbs. for transportation of snapped corn in carloads, Erath, La., to Miles, Tex., found unreasonable, and rate of 31 cents prescribed for the future. (20 I. C. C. 163.)

National League of Commission Merchants of the U. S. v. Atlantic Coast Line. Opinion by Commissioner Clark:

Rates on vegetables from Charleston, S. C., district to Buffalo, N. Y., and Pittsburg, Pa., found to be unreasonable to the extent that they exceed the combinations on Baltimore, Md. (20 I. C. C. 132.)

Complaint Dismissed.

W. I. & J. R. Thompson v. Louisville & Nashville et al. Opinion by the commission:

Charges on carload of plows from Evansville, Ind., to Huntsville, Ala., not unreasonable. (20 I. C. C. 161.)

William D. Scott v. Texas & New Orleans et al. Opinion by the commission:

Rate of $3.30 per net ton on coal, Carbon Hill, Ala., to Herbert switch, Tex., not found to be unreasonable. (20 I. C. C. 167.)

B. E. Blake & Son Hardware & Mfg. Co. v. Baltimore & Ohio et al. Opinion by Commissioner Prouty:

The rate on shipments of wrought-iron pipe from Youngstown, Ohio, to Liberal, Kan., is not found unreasonable, or in violation of section 3 of the act. (20 I. C. C. 139.)

Reduced Rate to Meet Competition.

Georgia-Carolina Brick Co. v. Southern Railway et al. Opinion by the commission:

The reduction by carriers of a rate via a long route to equal the rate via the short line is not of itself conclusive evidence of the unreasonableness of the higher rate, and claims for reparation based on the ground that the rate was reduced to meet such short-line rate must be denied. *Menefee Lumber Company* v. *T. & P.*, 15 I. C. C., 49, and *Commercial Coal Co.* v. *B. & O.*, 15 I. C. C. Rep., 11, reaffirmed. (20 I. C. C. 148.)

Commodity Rate Not Covered by Missouri River Case.

Wheeler & Motter Mercantile Co. v. Chicago, Burlington & Quincy. Opinion by Commissioner Clark:

Proportional third class rate applicable only on shipments from Atlantic seaboard territory, established under order of the commission in the *Burnham, Hanna, Munger case,* 14 I. C. C., 299, did not, and does not, apply to the movement of cotton piece goods, for which carriers maintained a commodity rate. (20 I. C. C. 141.)

Lower Rates via Silver Bow Prescribed.

E. P. Stacy & Sons v. Oregon Short Line et al. Opinion by Commissioner Clark:

Rates on apples and other deciduous fruits from Utah points to points in North Dakota, made in full combination on Silver Bow, Mont., and in excess of rates from same points of origin to same destinations via Omaha, found to be unreasonable. (20 I. C. C. 136.)

Restriction on the Freedom of Contract.

Baltimore Butchers' Abattoir & Live Stock Co. v. Philadelphia, Baltimore & Washington et al. Opinion by Commissioner Lane:

The refusal of defendants to deliver to the sidetrack of complainant, at Gwynn's Run, Baltimore, the live-stock shipments consigned thereto found unreasonable and in violation of law. Order issued that such delivery be hereafter made.

Carriers should not make contracts which abrogate the act to regulate commerce; they should not refuse, because of their own contract, to furnish a delivery that is reasonable on tracks which they use as a terminal for the shippers; and they should not discriminate between commodities in the delivery which they give, where no reason exists for such discrimination excepting the presence of a contract made with a private corporation, as in this case. (20 I. C. C. 124.)

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF DECEMBER, 1910. (SEE ALSO ISSUES FEBRUARY 10, 17 AND 24.)

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses						Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total, inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Alabama & Vicksburg	143	$118,012	$54,300	$184,299	$21,587	$24,320	$3,878	$58,585	$5,942	$114,312	$69,987	—$23	$5,596	$64,368	$7,121
Alabama Great Southern	309	273,425	114,456	420,191	50,884	89,486	9,811	126,319	9,209	285,709	134,482	—1,565	13,805	119,112	5,767
Ann Arbor	301	124,723	36,728	171,641	22,421	20,003	3,656	61,249	7,571	114,900	56,741	—4,510	14,265	37,966	4,716
Arizona Eastern	364*	93,725	34,897	136,792	26,136	12,088	2,342	38,699	3,969	83,234	53,558	—151	6,944	46,463	29,030
Carolina, Clinchfield & Ohio	236	126,970	10,386	140,524	14,324	17,206	5,127	35,907	8,952	81,516	59,008	550	5,500	54,058	33,372
Carolina, Clinchfield & Ohio of S. C.	18†	8,280	1,324	9,771	742	49	924	2,711	503	4,928	4,842	.....	200	4,642	6,259
Central Vermont	411	219,520	69,334	312,744	17,589	62,205	7,698	152,421	9,032	248,945	63,799	200	10,750	53,249	69,448
Chicago, Indiana & Southern	329	326,636	22,788	359,805	38,953	65,694	8,538	136,785	9,267	259,237	100,568	—300	12,818	87,450	—4,895
Cincinnati, New Orleans & Texas Pacific	337	613,144	156,542	808,979	77,757	177,605	23,361	231,472	18,459	528,654	280,325	—2,408	21,500	256,417	—20,075
Detroit, Toledo & Ironton	441	117,921	12,896	144,778	37,221	19,712	2,745	94,287	6,238	160,203	—15,425	.....	6,712	—22,137	—12,164
Georgia Southern & Florida	395	117,796	78,315	232,160	22,725	50,547	6,069	83,548	8,721	171,610	60,550	.....	7,921	52,629	—7,772
Grand Trunk Western	347	430,243	152,773	616,400	33,585	56,978	20,725	247,455	15,398	374,141	242,259	—1,268	31,697	209,294	73,273
Gulf & Ship Island	307	127,851	38,663	180,173	20,661	29,600	1,461	50,822	7,567	110,111	70,062	.....	5,303	64,759	11,814
Hocking Valley	350	489,603	72,256	583,562	92,373	109,221	8,727	216,290	20,709	447,320	136,242	.....	28,650	107,592	—30,773
International & Great Northern	1,159	571,301	206,082	827,053	92,050	110,048	20,304	406,552	22,342	651,296	175,757	—882	22,000	152,875	—10,191
Iowa Central	559	242,771	45,080	300,326	28,937	45,311	5,775	134,171	8,317	222,511	77,815	.....	9,813	68,002	25,268
Kanawha & Michigan	175	217,706	29,538	252,480	26,488	52,385	1,998	78,415	7,543	166,829	85,651	—10	7,193	78,448	45,614
Kansas City, Mexico & Orient	740	131,686	37,194	178,078	33,342	28,670	8,522	76,470	7,778	154,782	23,296	.....	2,705	20,591	19,136
Louisiana Ry. & Nav. Co	350	124,237	23,387	157,759	24,371	15,965	5,203	68,600	7,070	121,209	36,550	.....	4,400	32,150	19,801
Louisiana Western	207	126,317	60,687	196,725	31,620	19,936	6,906	57,427	7,702	123,591	73,134	—912	12,987	59,235	6,854
Minneapolis & St. Louis	1,027	292,793	91,651	414,844	41,597	57,057	9,383	178,163	18,109	304,309	110,535	—33	20,257	90,245	38,952
Minneapolis, St. Paul & S. S. Marie	3,573‡	1,167,350	375,113	1,668,017	167,597	266,984	54,676	716,283	39,050	1,244,590	423,427	333	93,168	330,592	—112,610
Missouri Pacific	3,920§	1,308,063	363,594	1,883,178	217,083	312,348	52,506	974,282	69,972	1,626,191	256,987	—2,304	83,500	171,183	—58,921
Morgan's La. & Texas R. R. & S. S. Co.	348	494,377	115,629	644,759	55,007	49,130	12,294	194,241	14,113	324,785	319,974	1,775	30,452	291,297	42,157
New Orleans & Northeastern	196	272,186	59,505	352,150	36,269	43,629	9,316	123,647	13,224	226,085	126,065	—241	10,037	115,787	21,539
New Orleans Great Northern	282	89,971	34,011	132,865	22,493	20,725	2,338	38,667	5,938	90,161	42,704	—94	2,200	40,410	—1,457
New Orleans, Mobile & Chicago	404	130,950	34,433	175,018	21,436	14,807	2,525	48,003	8,883	95,654	79,364	.....	5,435	73,929	13,753
New Orleans, Texas & Mexico	264	97,340	16,711	123,533	17,668	9,865	3,395	52,468	7,496	90,892	32,641	.....	3,388	29,253	36,601
St. Louis, Iron Mountain & Southern	3,316¶	1,801,698	577,488	2,576,696	392,924	298,410	53,288	825,723	78,107	1,648,452	928,244	—2,996	78,919	846,329	72,074
San Antonio & Aransas Pass	724	254,146	90,018	363,944	77,339	44,266	5,095	142,089	9,775	278,564	85,380	.....	10,000	75,380	1,982
San Pedro, Los Angeles & Salt Lake	1,105	469,616	245,102	763,276	100,220	113,133	33,213	269,490	18,989	535,045	228,231	—7,306	30,206	190,719	69,841
Spokane, Portland & Seattle	433	201,707	81,053	293,217	37,674	12,697	3,887	76,741	9,979	140,978	152,239	—2,644	38,500	111,095	111,299
Trinity & Brazos Valley	462	200,176	32,747	237,975	33,466	26,952	8,137	90,185	13,482	172,222	65,753	.....	4,685	61,068	15,548
Vicksburg, Shreveport & Pacific	171	84,213	55,968	151,168	20,828	21,532	2,787	46,499	5,204	96,850	54,318	—201	4,675	49,442	14,929
Western Maryland	543	466,690	60,148	553,416	54,139	75,177	7,725	234,375	13,246	384,662	168,754	—2,781	19,500	146,473	—
Wheeling & Lake Erie	457	436,095	47,085	520,932	40,782	129,042	8,634	214,494	14,886	407,838	113,094	8,518	20,209	101,403	—49,806
SIX MONTHS OF FISCAL YEAR 1911.															
Alabama & Vicksburg	143	$600,816	$270,257	$937,509	$119,043	$147,981	$22,541	$309,854	$31,695	$631,114	$306,395	—$281	$28,446	$277,668	$21,824
Alabama Great Southern	309	1,530,682	600,798	2,319,316	279,658	521,183	60,961	693,893	54,684	1,610,379	708,937	—4,546	79,464	624,927	88,596
Ann Arbor	301	668,622	278,533	1,011,298	140,273	116,172	23,753	336,453	40,095	656,746	354,552	7,877	85,591	276,838	23,733
Arizona Eastern	364*	568,490	199,098	825,053	151,601	75,102	11,896	233,442	25,017	497,058	327,995	—151	34,988	292,856	—7,097
Carolina, Clinchfield & Ohio	236	668,349	88,011	781,004	76,491	108,823	31,862	172,823	48,871	438,870	342,134	550	33,000	309,684	165,872
Carolina, Clinchfield & Ohio of S. C.	18†	36,080	8,659	46,371	3,662	308	5,493	13,993	3,081	26,537	19,834	.....	1,200	18,634	—
Central Vermont	411	1,278,563	614,435	2,044,572	264,751	305,286	45,224	867,615	44,146	1,527,022	517,550	3,977	63,867	457,660	807
Chicago, Indiana & Southern	329	1,604,565	158,496	1,813,910	264,825	349,826	56,018	705,639	54,288	1,430,596	383,314	1,461	80,693	304,082	—131,064
Cincinnati, New Orleans & Texas Pacific	337	3,710,537	867,601	4,810,112	515,454	871,679	124,223	1,301,126	107,025	2,919,507	1,890,605	—6,369	129,000	1,755,236	219,945
Detroit, Toledo & Ironton	441	870,037	94,202	1,044,612	195,806	177,550	17,376	527,874	33,961	952,567	92,045	—73	40,272	51,700	—14,305
Georgia Southern & Florida	395	660,325	400,397	1,231,002	134,132	247,386	36,292	449,792	54,216	921,818	309,184	.....	57,304	251,880	—30,589
Grand Trunk Western	347	1,847,893	1,058,134	3,118,551	335,271	441,577	109,624	1,290,050	78,617	2,255,140	863,411	—6,884	190,184	666,343	—148,320
Gulf & Ship Island	307	721,270	223,474	1,012,575	122,114	173,104	10,298	283,851	47,070	636,437	376,138	.....	31,364	344,774	35,348
Hocking Valley	350	3,450,620	487,040	4,204,611	543,886	614,541	54,042	1,271,145	97,355	2,580,969	1,623,642	.....	178,335	1,445,307	—32,055
International & Great Northern	1,159	3,587,334	1,134,742	5,024,925	692,520	686,547	116,411	1,943,890	128,711	3,568,079	1,456,846	—2,171	130,000	1,324,675	379,251
Iowa Central	559	1,416,078	306,133	1,800,507	219,801	315,514	42,048	721,679	53,257	1,352,299	448,208	.....	58,741	389,467	—26,648
Kanawha & Michigan	175	1,470,779	190,925	1,695,567	185,531	300,750	14,351	453,806	39,537	993,975	701,592	—80	47,229	654,283	243,767
Kansas City, Mexico & Orient	740	720,550	245,412	1,019,662	195,137	199,491	46,467	452,305	46,707	940,107	79,555	.....	25,276	54,279	—53,660
Louisiana Ry. & Nav. Co	350	665,682	126,124	870,731	156,765	101,428	29,893	354,696	37,289	680,071	190,660	.....	26,400	164,260	61,592
Louisiana Western	207	679,092	322,036	1,050,813	113,231	147,293	37,357	304,480	44,088	646,449	404,364	530	43,372	361,522	—28,350
Minneapolis & St. Louis	1,027	1,910,887	692,552	2,779,922	312,788	341,238	65,992	1,056,762	87,645	1,864,425	915,497	—228	122,976	792,293	—76,347
Minneapolis, St. Paul & S. S. Marie	3,573‡	8,140,120	2,740,451	11,615,076	1,195,139	1,558,027	262,227	4,050,366	240,723	7,306,482	4,308,594	93,155	649,583	3,752,166	—1,562,539
Missouri Pacific	3,920§	9,378,486	2,569,495	13,270,655	2,052,696	2,121,890	361,137	5,743,051	421,341	10,700,115	2,570,540	—13,727	501,000	2,055,813	—
Morgan's La. & Texas R. R. & S. S. Co.	348	1,980,517	595,862	2,729,326	343,140	301,763	66,615	915,710	80,696	1,707,923	1,021,403	—10,519	119,233	891,651	30,302
New Orleans & Northeastern	196	1,385,891	319,524	1,815,355	180,797	267,947	55,375	634,806	67,045	1,205,970	609,385	—461	52,787	556,137	40,359
New Orleans Great Northern	282	568,091	196,402	836,965	126,491	121,407	18,636	228,301	28,384	523,189	313,776	—479	10,950	302,347	77,895
New Orleans, Mobile & Chicago	404	674,590	177,452	912,830	125,595	72,655	17,524	267,789	47,489	531,052	381,778	.....	26,576	355,202	70,699
New Orleans, Texas & Mexico	264	462,955	88,688	595,522	102,714	66,355	21,978	245,106	45,212	481,365	114,157	.....	5,282	108,875	76,507
St. Louis, Iron Mountain & Southern	3,316¶	10,156,437	3,133,997	14,424,721	2,263,808	1,972,352	338,785	4,904,558	456,280	9,935,783	4,488,938	—16,185	471,499	4,001,254	—464,843
San Antonio & Aransas Pass	724	1,664,684	604,694	2,393,497	380,577	285,394	29,657	774,697	56,609	1,526,934	866,563	.....	56,000	810,563	126,020
San Pedro, Los Angeles & Salt Lake	1,105	2,455,828	1,401,724	4,113,650	763,225	598,360	183,598	1,440,984	99,931	3,086,098	1,027,552	—29,958	160,657	836,937	—248,202
Spokane, Portland & Seattle	433	1,768,343	525,594	2,411,834	268,030	147,227	23,224	628,527	57,840	1,124,848	1,286,986	—5,366	197,600	1,084,020	605,132
Trinity & Brazos Valley	462	916,642	205,616	1,168,383	202,416	194,733	47,944	500,439	65,788	1,011,320	157,063	.....	22,185	134,878	4,462
Vicksburg, Shreveport & Pacific	171	473,750	265,937	797,497	109,904	131,574	20,330	237,122	27,392	526,322	271,175	—279	34,850	236,046	51,106
Western Maryland	543	3,034,388	579,788	3,776,090	475,848	442,620	59,432	1,275,470	75,540	2,328,910	1,447,180	—1,722	117,000	1,328,458	—
Wheeling & Lake Erie	457	3,101,346	340,794	3,685,800	430,653	702,577	51,998	1,281,779	82,603	2,549,610	1,136,190	20,339	126,858	1,029,671	—16,417

Mileage operated on December 31, 1909.—* 336 miles; ‡ 3,425 miles, including Wisconsin Central for both years; § 3,881 miles; ¶ 2,610 miles.
† Commenced operation December 11, 1909. — Indicates Deficits, Losses and Decreases.

Followed Routing Instructions.

West Oregon Lumber Co. v. Astoria & Columbia River Railroad et al. Opinion by the commission:

A carrier does not misroute a shipment when the routing instructions given by the shipper are observed, and it is not liable to the shipper for charges applicable over such route in excess of the charges over another available route. (20 I. C. C. 151.)

Dubuque Bridge Charge Not Unreasonable.

Board of Railroad Commissioners of Iowa v. Illinois Central Railroad et al. Opinion by Commissioner Harlan:

A total charge approximating 30 cents per passenger, consisting of a toll of 25 cents and mileage, for passage across the Dubuque bridge found not to be unreasonable when viewed from the standpoint of all the carriers participating in the traffic.

The net revenues of a carrier have often an undoubted and important bearing on the question of the reasonableness of its rates, but the fact that they are greater than the returns on ordinary business enterprises is not sufficient in itself to justify a finding that the rates are excessive; the value of the service and other factors that enter into the construction of rates must also be taken into consideration. (20 I. C. C. 181.)

Given a Lard Substitute Rate.

Nucoa Butter Co. v. Erie et al. Opinion by Chairman Clements:

Complainant refines cocoanut oil, and ships, under trade names, a pure cocoanut oleine, which is chiefly used as a substitute for lard, and a pure cocoanut stearin, which is used as a substitute for cocoa butter. Defendants, under the Official Classification, rate complainant's oleine with cocoanut oil and rate its stearin with cocoa butter. Cocoanut oleine competing mainly with lard and lard compounds should be rated not higher than lard and lard substitutes, and that this record furnishes no ground on which to modify the present rating of cocoanut stearin. (20 I. C. C. 174.)

Failure to Load Properly.

Consolidated Water Power & Paper Co. v. San Pedro, Los Angeles & Salt Lake et al. Opinion by the commission:

A tariff provided that when more of an article is shipped on one day by one consignor to one consignee than can be loaded in one car, if the first car is loaded to its full visible capacity, the balance may be carried in a second car at the carload rate on the actual weight. It appears that though the shipment herein could have been so loaded as to bring it within the privilege of this rule and both cars shipped on the same day, or could have been so loaded that the weight in each car would have exceeded the minimum weight applicable thereto, it was not done. The complainant is not entitled to reparation for the difference between the minimum weight on the part carload and the actual weight thereof. (20 I. C. C. 169.)

South Western Rate Decision.

On February 24 the commission announced three important decisions. Two of these, affecting large numbers of roads, are noticed in another column. The third was the case of the Railroad Commission of Texas against the Atchison, Topeka & Sante Fe and other carriers, known as the Southwestern rate case. In this the commission decline to disturb the commodity rates or the first class rates complained of, but orders the defendants to reduce the second class rates, which were increased from $1.21 to $1.29, to $1.25. On the remaining classes the roads are required to restore the rates in effect before the increased rates were published. The opinion was prepared by Commissioner Harlan. The amount of the increased revenue involved in the proposed advances was not so considerable as in either of the other cases. The increases were defended by the carriers, however, on the same grounds of insufficient revenues and inadequate returns on investments. In the general rate revision made by the roads the first class rate from St. Louis to Texas common points was increased from $1.37 to $1.47, and corresponding increases were made in the other classes. The commodity rates also were substantially increased. Commissioner Harlan finds that the roads in the Southwest have not prospered as have many in other parts of the country and he declines to disturb the increased first class rate.

STATE COMMISSIONS.

Henry Jastremski has been elected secretary of the Railroad Commission of Louisiana.

Winfield A. Huppuch has been appointed a member of the New York State Public Service Commission, Second district, in place of John N. Carlisle, whose term has expired.

COURT NEWS.

The Full Crew Law Decision.

The Supreme Court of the United States has sustained the law of Arkansas, regulating the number of men to be employed on freight trains, as briefly reported in the *Railway Age Gazette* last week, page 366 (February 24). The suit was that of the Chicago, Rock Island & Pacific against the state, the supreme court of Arkansas having sustained the law.

The law requires an engineman, a fireman, a conductor and three brakemen on every freight train of 25 cars or more, "regardless of any modern equipment." Railways not over 50 miles long are excepted; penalty $100 to $500 for each violation, but the penalties are not to apply during strikes of trainmen. The train with which the offense was committed was equipped with both air brakes and automatic couplers and it had two brakemen; and the company declared that the requirement of a third man was unnecessary, and therefore a taking of its property without due process of law.

The decision, by Justice Harlan, says that the principle sustaining this law has been fully settled by former decisions, but quotations are given from a few of these earlier decisions. In the case of the Alabama law requiring locomotive enginemen to have licenses, Justice Matthews laid down the dictum that legislation might affect commerce without constituting a regulation of it. The Alabama license requirement only indirectly, incidentally and remotely affects interstate commerce, although the engineman in the case tried ran regularly to and from a point in Mississippi. The Alabama color blind law was decided in the same way. The law was not directed against commerce and affected it only incidentally.

The New York law, forbidding fires in passenger cars, was assailed by the New York, New Haven & Hartford as repugnant to the constitution, but the court held that it was for the protection of all persons traveling in the state of New York; and interstate passengers are entitled to as full protection as others. There may be a doubt as to the wisdom of such regulations, but that is a matter for the state to determine. Even if interstate trains were delayed and passengers inconvenienced, such inconvenience cannot be avoided so long as the individual states are sovereign. This law, like the Arkansas Full Crew law, does not apply to short railways, but this exception was justified by the court on the ground that the law-makers had undoubtedly deemed it more important to protect heavy through trains. The contention that the statute denied the plaintiff the equal protection of the laws, was therefore rejected.

Justice Harlan holds that in Arkansas passengers on interstate trains are as fully entitled to the benefits of local laws as are citizens of the state. The state has never surrendered its power of caring for the public safety, and the validity of such statutes is not to be questioned in a federal court unless they are clearly inconsistent with some power granted to the general government, or with some right secured by the federal constitution, or unless they are purely arbitrary in their nature. The Full Crew law was enacted in aid, not in obstruction of interstate commerce. There is room for controversy as to the wisdom of the law, but it is not so unreasonable as to justify the court in condemning it because of its arbitrariness. It is a means employed by the state to accomplish an object which it is entitled to accomplish, and such means, even if deemed unwise, are not to be condemned if they have a real relation to that object. Undoubtedly Congress in its discretion may take entire charge of the whole subject of the equipment of interstate cars and establish such regulations as are necessary and proper for the protection of those engaged in interstate commerce; but it has not taken action in regard to train crews, and until it does, the statutes of the state, if not arbitrary, and if they really relate to the rights and duties of all within the jurisdiction, must control.

Railway Officers.

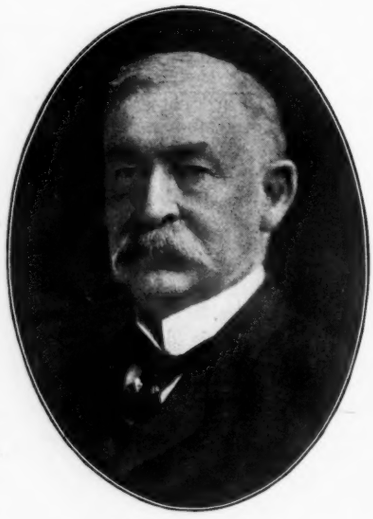
ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Richard Vipon Taylor, whose election as vice-president and general manager of the Mobile & Ohio, with office at Mobile, Ala., has been announced in these columns, was born on August 11, 1859, at Newbern, N. C. Mr. Taylor was educated at Barton Academy, in Mobile, Ala., and began railway work on September 27, 1877, as a clerk in the accounting department of the Mobile & Ohio. He held various positions, including that of general bookkeeper, in that department until 1888. He was then appointed general auditor, remaining in that position until October, 1904, when he was made general manager of the same road, which position he held at the time of his recent election as vice-president, in addition to his duties as general manager. Mr. Taylor is also vice-president and general manager of the Southern Railway in Mississippi.

R. V. Taylor.

Charles Edmund Pugh, first vice-president of the Pennsylvania Railroad Company, whose retirement on March 1, under the pension rules of the company, has been announced in these columns, was born at Unionville, Chester county, Pa., February 25, 1841. He was educated in the public school of his native town, and at the State Normal School at Millersville, Lancaster county, Pa. On graduation he went to work in the office of his father, Elijah Pugh, who was in business as a merchant. Mr. Pugh entered the service of the Pennsylvania Railroad as agent at Newport, Perry county, Pa., on October 1, 1859. He served as a passenger conductor for six months. In 1864 he was appointed train despatcher of the Philadelphia division, and in August, 1870, was made general agent at Philadelphia. On April 1, 1879, he was appointed general superintendent of the Pennsylvania Railroad division; and in October, 1882, was appointed general manager. He was elected in March, 1893, third vice-president; and on February 10, 1897, second vice-president. In this position his duties were principally concerned with the operating department of the road, including motive power. On March 24, 1909, Mr. Pugh became first vice-president in charge of the purchasing, insurance, real estate and pension departments. He was also first vice-president of the Northern Central, the Philadelphia, Baltimore & Washington and the West Jersey & Seashore; and a director of the Long Island Railroad and of many other companies in the Pennsylvania system. The following is an extract from the minutes adopted by the board of directors on February 24: "As vice-president he was charged with the supervision of the transportation, enginering, real estate, purchasing and insurance department. He has also been a member of the advisory board of the Pennsylvania Railroad employees' voluntary relief department since its organization in 1886, and a member and chairman of the board of officers of the pension department since its establishment in 1900, and in both of these departments has always manifested a lively interest, and has been a potent factor in their development and administration. For eighteen years he has sat in the highest councils of the company, contributing to their deliberations the benefit of his intimate knowledge of its properties, and of an experience gained in thirty-four years of actual contact with practical railroading during the period of its greatest development. Mr. Pugh's value to the service is not measured solely by his ability and skill as a transportation and executive officer. Endowed by nature with a happy combination of firmness of character and a most gentle and lovable disposition, he has ever been held in high esteem as well by the army of employees over whom he exercised authority as by his official associates, and the conspicuous loyalty of his subordinate officers is attributable as much to their personal affection for him as to the esprit de corps which is the stronghold of the Pennsylvania Railroads organization. In recording his retirement, the board bear testimony to the value of his long, efficient and intelligent service, and to the fidelity to duty and earnestness of purpose which have characterized half a century's devotion to the interests of the company, and while congratulating him upon the attainment of a well earned relief from the burden and strain of official responsibilities, express the hope that it may bring with it many years of health and happiness, and that the severance of official relations may serve to bind closer the personal ties which have existed for so many years."



Charles E. Pugh.

David Bosman, secretary of the Erie Railroad, at New York, has been elected vice-president and secretary, and F. H. Wright has been appointed an assistant secretary, both with offices at New York.

Daniel Willard, president of the Baltimore & Ohio, has been elected president also of the Cincinnati, Hamilton & Dayton, with office at Baltimore, Md., succeeding William Cotter, who has resigned from that company, but retains the presidency of the Pere Marquette. G. F. Randolph, first vice-president of the Baltimore & Ohio, has been elected vice-president also of the Cincinnati, Hamilton & Dayton, in charge of traffic, with office at Baltimore.

Sydney Rhodes Prince, whose appointment as general counsel of the Mobile & Ohio, with office at Mobile, Ala., has been announced in these columns, was born September 11, 1876, at Mount Sterling, Ala. He graduated from Barton Academy, Mobile, in 1893, and three years later was given the degree of A. B. by the University of Alabama, and in 1898 he graduated from Georgetown University law school. He was appointed personal injury attorney for the Mobile & Ohio, January 1, 1901, and in December, 1906, was made attorney for the Mobile & Ohio system. He was appointed assistant general counsel in January, 1908, which position he held at the time of his recent appointment as general counsel.

Operating Officers.

Thomas F. Brennan, general superintendent of the Buffalo, Rochester & Pittsburgh, has been appointed general manager, with office at Rochester, N. Y.

M. J. Wise has been appointed superintendent of the Southern Railway in Mississippi, with office at Columbus, Miss., succeeding H. Hatcher, resigned to go with another company.

G. L. Griggs, trainmaster of the Chicago, Burlington & Quincy, at Sterling, Colo., has been appointed trainmaster, with office at Omaha, Neb., succeeding J. B. Austin, assigned to other duties. W. F. Pate succeeds Mr. Griggs.

Otto Holstein, whose appointment as trainmaster of the Central Railway of Peru, with office at Lima, Peru, was recently announced in these columns, has been promoted to operating manager (superintendent of transportation), succeeding W. E. Paige, resigned.

H. E. Warner, superintendent of the Southern division of the Detroit, Toledo & Ironton at Springfield, Ohio, has had his jurisdiction extended over the Northern division, with office at Springfield, succeeding on the Northern division W. M. Lockard, assigned to other duties.

H. Hatcher, superintendent of the Southern Railway in Mississippi, has been appointed superintendent of the Georgia, Southern & Florida, instead of general superintendent, as previously announced in these columns, with office at Macon, Ga. O. M. Grady, general superintendent at Macon, having resigned to go into other business, that position has been discontinued.

James T. Robertson, assistant general manager and general freight and passenger agent of the Cumberland & Pennsylvania, has been appointed general manager, with office at Cumberland, Md., succeeding C. L. Bretz, deceased. Mr. Robertson was born in 1873, at Ocean, Md., and was educated in the public schools. He began railway work in May, 1890, on the Cumberland & Pennsylvania as a messenger at Lonaconing, Md. He studied telegraphy, and in 1891 was appointed telegraph operator at the same place, remaining in that position for three years. He was then transferred to the general offices in Cumberland as clerk and stenographer to the general freight and passenger agent and to the superintendent. In June, 1904, he was appointed chief clerk to the general manager, remaining in that position until July, 1907, when he was made general passenger and freight agent. He was later appointed assistant general manager and general freight and passenger agent.

J. T. Robertson.

Harvey Rittenhouse, engineer maintenance of way of the Cumberland & Pennsylvania, has been appointed assistant general manager, with office at Cumberland, Md. Mr. Rittenhouse was born in Montgomery county, Pa., in 1868, and was educated in the public schools, and later at the Norristown (Pa.) high school. He then took a course in civil engineering at the Polytechnic College of Pennsylvania. He began railway work in July, 1889, on the Norfolk & Western as assistant supervisor, and was later supervisor, roadmaster and assistant engineer. In November, 1899, he was appointed assistant engineer maintenance of way on the West Virginia Central & Pittsburgh, now a part of the Western Maryland, and in August of the following year left that company to go to the Denver & Rio Grande, where he was engaged in location, construction and maintenance work. From November, 1903, to March, 1904, he was in charge of a party making preliminary surveys in Utah for the Denver, Northwestern & Pacific, and from August to September, 1904, he was roadmaster of the Rio Grande Southern. He was appointed engineer maintenance of way of the Cumberland & Pennsylvania in September, 1904, which position he held at the time of his recent appointment.

H. Rittenhouse.

Henry W. Thornton, whose appointment as assistant general superintendent of the Long Island, has been announced in these columns, was born November 6, 1871, at Logansport, Ind. Mr. Thornton was educated at St. Paul's school, Concord, N. H., and later studied civil engineering at the University of Pennsylvania, graduating in 1894. He began railway work in December of the same year as draftsman, in the chief engineer's office of the Pennsylvania lines west of Pittsburgh, and held various positions in that office and the construction department until June, 1897, when he was appointed supervisor at Columbus, Ohio. From November, 1897, to April, 1899, he was assistant engineer of the Cincinnati division, and then for seven months was engaged in special work under the general manager. He was appointed engineer of maintenance of way of the Erie & Ashtabula division November 1, 1899, and in March, 1901, was made superintendent of the Marietta division. He went to the Cleveland, Akron & Columbus as superintendent in April, 1902, and returned to the service of the Pennsylvania System as superintendent of the Erie & Ashtabula division in December, 1903, which position he held until his recent appointment as assistant general superintendent of the Long Island.

H. W. Thornton.

Traffic Officers.

A. E. Yardley has been appointed a traveling freight agent of the Chicago, Milwaukee & Gary, with office at Chicago.

S. C. Baird has been appointed traveling passenger agent of the Illinois Central, with office at Chicago, succeeding R. Anderson, promoted.

J. F. McDoel having resigned as commercial agent of the Chicago, Indianapolis & Louisville, with office at La Fayette, Ind., that office is abolished.

J. E. Bell has been appointed a commercial agent of the Chicago, Rock Island & Pacific, with office at McAlester, Okla., succeeding A. D. Aiken, transferred.

A. A. Poland, agent of the Rutland Transit Company at St. Louis, Mo., has been appointed westbound agent of the New York Central Lines, with office at St. Louis.

R. D. Jones, freight solicitor of the Empire Line at Chicago, has been appointed agent, with office at Milwaukee, Wis., succeeding F. L. Wolfe, resigned to go into other business.

William W. Ruth has been appointed a commercial freight agent of the Baltimore & Ohio, with office at Baltimore, Md., succeeding H. W. Atkinson, resigned to go into other business.

F. D. Colby, special agent coal traffic of the New York Central Lines east of Buffalo, N. Y., with office at New York, has resigned to go into other business, and that position has been abolished.

Charles Reid has been appointed agent of the Western Railway Weighing Association and Inspection Bureau, with office at Little Rock, Ark., succeeding E. F. Crehore, resigned to engage in other business.

C. K. Bothwell, district passenger agent of the Missouri Pacific at Joplin, Mo., has been appointed district passenger agent,

with office at Wichita, Kan. Frank P. Prosser, city passenger and ticket agent at Joplin, succeeds Mr. Bothwell.

R. A. Chadwick, assistant general freight agent of the Tennessee Central at Nashville, Tenn., has been appointed general freight and passenger agent, with office at Nashville, succeeding Theodore A. Rousseau, resigned, and his former office has been abolished.

Paul D. Warren, general agent in the passenger department of the Michigan Central, the Lake Shore & Michigan Southern and the Cleveland, Cincinnati, Chicago & St. Louis, with office at Toledo, Ohio, has had his jurisdiction extended over the Toledo & Ohio Central.

E. A. Niel, traffic manager of the Buffalo & Susquehanna Railroad and the Buffalo & Susquehanna Railway, at Buffalo, N. Y., having resigned, that office has been abolished and the duties of that position will be performed by W. E. Farris, general freight and passenger agent, with office at Buffalo.

H. G. Elliott, assistant general passenger agent of the Grand Trunk, at Chicago, has been appointed general passenger agent, with office at Montreal, Que., succeeding George W. Vaux, resigned. J. D. McDonald, district passenger agent, at Toronto, Ont., succeeds Mr. Elliott, and A. E. Duff, district passenger agent, at Winnipeg, Man., succeeds Mr. McDonald.

George W. Luce, general freight agent of the Southern Pacific at San Francisco, Cal., has been appointed assistant to the vice-president in charge of traffic, with office at San Francisco. Thomas A. Graham, assistant general freight and passenger agent at Los Angeles, Cal., succeeds Mr. Luce. John G. Stubbs, assistant general freight agent at San Francisco, has been appointed a general freight agent of the Southern district, and F. E. Batturs, assistant general passenger agent at San Francisco, has been appointed a general passenger agent of the Southern district, both with offices at Los Angeles.

George H. Bower, whose appointment as assistant general passenger agent of the Illinois Central and the Indianapolis Southern, with office at Chicago, has been announced in these columns, was born August 29, 1868, at Newark, Ohio. He graduated from a private high school at Pomeroy, Ohio, and began railway work in 1884 in the passenger department of the Lake Shore & Michigan Southern at Cleveland, Ohio. In June, 1887, he went with the Missouri Pacific at St. Louis, Mo., as assistant chief rate clerk, and in January of the next year he became chief clerk to the general passenger agent of the Louisville, New Orleans & Texas, now the Yazoo & Mississippi Valley, at Memphis, Tenn. He went with the Illinois Central in March, 1892, as a rate clerk, and has been promoted consecutively to chief rate clerk, chief clerk, and assistant general passenger agent, as above. It was erroneously stated in our issue of February 24, that Mr. Bower was formerly general baggage agent of the Missouri, Kansas & Texas at Parsons, Kan.

Engineering and Rolling Stock Officers.

J. H. Bransford has been appointed a general foreman of the Chesapeake & Ohio, with office at Thurmond, W. Va., succeeding Frank J. Walsh, resigned to go to the Chicago Pneumatic Tool Company.

M. R. Smith, master mechanic in charge of terminals of the Chicago, Indianapolis & Louisville at Lafayette, Ind., has been appointed shop master mechanic, with office at Lafayette, succeeding O. S. Jackson, resigned to go to another company.

E. N. Layfield, division engineer of the Baltimore & Ohio Chicago Terminal Railroad (and formerly chief engineer of the Chicago Terminal Transfer) at Chicago, has resigned to become a member of the grade separation commission of Grand Rapids, Mich.

A. C. Adams has been appointed superintendent of motive power of the Spokane, Portland & Seattle, with office at Portland, Ore. He will have charge of the maintenance of the motive power, machinery and equipment, and conjointly with the general superintendent, the operation of the same.

W. J. Lank has been appointed a division engineer of the Atchison, Topeka & Santa Fe, with office at Clovis, N. Mex., succeeding R. J. Gatewood. G. E. Hanson has been appointed a roadmaster on the Eastern division, with office at Topeka, Kan., succeeding John Hauke. W. Eglinton, roadmaster on the Middle division at Mulvane, Kan., has had his headquarters changed to Arkansas City, Kan., and Leroy Bradley has been appointed roadmaster on the Colorado division, with office at Pueblo, Colo., succeeding J. G. Butcher.

Purchasing Officers.

R. J. Moore has been appointed a division storekeeper of the Atchison, Topeka & Santa Fe, with office at Argentine, Kan., succeeding A. P. Kephart.

W. R. Shrodes has been appointed chief clerk and purchasing agent of the Quincy, Omaha & Kansas City and the Iowa & St. Louis, with office at Kansas City, Mo., succeeding L. A. Irwin, resigned.

W. L. Cooper, assistant storekeeper of the Chicago & Alton at Bloomington, Ill., having resigned to accept service with another company, the duties of that office are combined with those of the general storekeeper, and the title of assistant storekeeper has been abolished.

Special Officers.

Charles G. Hall, general advertising agent of the Chicago & North Western, with office at Chicago, has resigned to join the staff of the Curtis Publishing Company.

Stanley D. Roberts, assistant advertising manager of the Chicago, Milwaukee & St. Paul, has been appointed advertising agent, succeeding Charles S. Young, resigned.

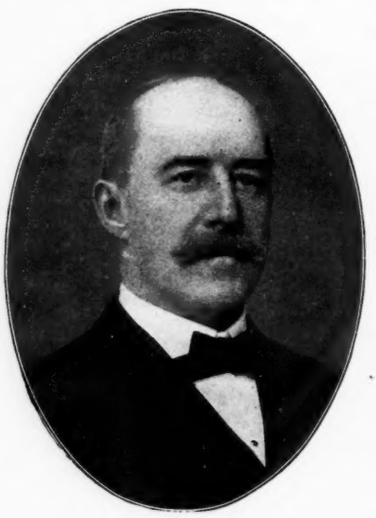
OBITUARY.

Daniel Carmichael, formerly engineer of construction work of the Union Pacific, died at Los Angeles, Cal., on February 24, at the age of 67 years.

Frank K. Kelly, traveling freight agent of the Chicago, Burlington & Quincy, with office at Chicago, died at his home in Milwaukee, Wis., on February 19.

W. H. Bradford, formerly for many years general agent at Milwaukee, of the Great Western Railway of Canada, and the Detroit & Milwaukee, both now parts of the Grand Trunk, died recently in Milwaukee at the age of 86 years.

Charles D. Simonson, one of the oldest and best known freight men in the East, died on February 15, at his home in Brooklyn, N. Y., after a short illness, as previously announced in these columns. He was formerly on the Pacific coast, representing the old Sutton Line of packet ships, just before the overland railways were built. Then he was for a number of years general eastern agent of the Atchison, Topeka & Santa Fe, at New York, from which position he resigned ten years ago to become the general eastern agent of the Colorado Midland. While representing that company he secured an unusually large amount of business for such a comparatively small road. In July, 1910, the Colorado Midland having merged its outside agencies with those of the Chicago, Burlington & Quincy, Mr. Simonson was appointed special agent, freight department, of the Rock Island, which position he held at the time of his death. He was a man of great energy, always cheerful and courteous, and he easily won the friendship of those in authority and of the many others with whom he came in business contact in transportation circles. He is survived by a widow and one daughter.



C. D. Simonson.

Railway Construction.

New Incorporations, Surveys, Etc.

ALEXANDRIA & WESTERN.—An officer is quoted as saying that this road is to be built in the near future from Alexandria, La., westerly towards Leesville and eventually into Texas. W. H. Larson, secretary and treasurer; I. W. Sylvester, chief engineer, Fort Worth, Texas. (April 1, p. 917.)

ATCHISON, TOPEKA & SANTA FE.—According to press reports, this company will build an extension under the name of the Pecos Valley & Northeastern from Pecos, Texas, south about 150 miles to Boquillas.

BADGER RAILWAY & LIGHT CO. (Electric).—This company is about to begin work on a line between Lake Geneva, Wis., and Whitewater, 22 miles. The company will carry out the work with its own men. G. Prickhard, chief engineer, 711 Majestic building, Milwaukee. (February 10, p. 301.)

BLUE RIDGE.—Organized with $600,000 capital, to build a 30-mile line from near Winchester, Va., to a connection with the Southern Railway. Mrs. A. M. Moore, Cleveland, Ohio, is the principal promoter.

BUCKHANNON & NORTHERN.—The Patterson, Moran & Luck Co., Pittsburgh, Pa., who have the contract for building a 30-mile section from the Pennsylvania-West Virginia state line, to Rivesville, W. Va., have sub-let the work as follows: The first five miles to G. S. Fogel & Co., St. Albans, W. Va.; second five miles to Zeverly & Co., Morgantown; the next 15 miles to the Pennsylvania Contracting Co., Pittsburgh, Pa., and five miles to Marshall, Sale & Co., Roanoke, Va. Grading work will be started at once. The line will open up a coal district in West Virginia. (February 17, p. 335.)

CANADIAN NORTHERN.—Announcement is made that work on the connecting line from Ottawa, Ont., west to Port Arthur, is to be started this coming spring. In addition, plans have been made to build about 1,500 miles of branch lines in the prairie provinces. (August 26, p. 372.)

CANADIAN PACIFIC.—An officer writes regarding the reports that contracts are to be let soon for building between Toronto, Ont., and Smith's Falls, that the question of carrying out this work is under consideration, but the work has not yet been authorized. (February 24, p. 368.)

This company is ready to receive bids for the construction of the second section of 30 miles of the Kootenay Central. The line is projected a distance of 175 miles and when completed will connect Golden, B. C., on the main line, with a point near Galloway, on the Crow's Nest extension. The first section of 10 miles was completed some time ago. The line is to be built in sections of about 40 miles, as circumstances in the British Columbia new settlement district seem to warrant.

CHICAGO & NORTH WESTERN.—Under the name of the St. Louis, Peoria & Northwestern, it is said that this company will build a 100-mile line from Peoria, Ill., into the Illinois coal fields.

Announcement has been made by the Chicago & Northwestern Railroad that about $700,000 is to be spent in improvements at Boone, Ia. A new yard of three times the present capacity will be installed.

CLEVELAND, AKRON & COLUMBUS.—An officer writes that surveys for a proposed change of line between Brinkhaven, Ohio, and Danville, three miles, have been made, but the company does not intend to carry out this work in the near future.

EASTERN UTAH.—Incorporated in Utah with $500,000 capital, to build about 60 miles of line from Wellington, Carbon county, Utah, southwest to Emery, Emery county, about 60 miles. The incorporators include: H. Wade, president, Price; O. Seely, vice-president, Castle Dale; N. V. Maloney, secretary, and I. R. Parsons, treasurer, both at Price.

FORT SMITH & WESTERN.—According to press reports, this company will take out a charter in Oklahoma in the near future for the purpose of buiiding an extension from the present western terminus of the St. Louis, El Reno & Western, at El Reno, Okla., southwest to a connection with the Kansas City, Mexico & Orient, near the Red river.

FREDERICK RAILROAD.—An officer writes regarding the reports that a number of extensions are to be built, that the company is increasing its terminal facilities, but does not contemplate building any lines through Middletown valley. The company now operates a 17-mile line from Thurmont, Md., to Frederick.

GARDEN CITY, GULF & NORTHERN.—An officer writes that an extension is being built under the name of the Scott City Northern, from Garden City, Texas, north to Scott City, thence via Logan county, to Winona, on the Union Pacific, 50 miles. It is expected to have the line finished by July 1, 1911. Track has been laid on 20 miles. The work is heavy and includes handling about 15,000 cu. yds. per mile. Maximum grades will be 0.7 per cent. There will be 10 trestle bridges, to have a combined length of one mile. The line is being built to carry live stock, sugar beets and farm products. Contracts have been let to A. L. Sedbrook, S. S. Shaw, H. W. Harper, A. J. Canady, S. Brown, all of Scott City, and the Midland Bridge Company, Kansas City, Mo. (December 2, p. 1096.)

GEORGIA ROADS.—J. N. Searwood, president of the Searwood Lumber Co., Brooklet, Ga., writes that this company which now operates six miles of line from Brooklet, south, is planning to build an extension either to Pembroke or Groveland, about 20 miles from Brooklet; also, that an extension may be built north to Oliver, 12 miles. It is the intention of the company to complete four miles of the southern extension at once, for which rails have already been received.

GRANTS PASS & ROGUE RIVER.—An officer writes that contracts are being let and work is to be started early in March on a line from Grants Pass, Ore., to the head of Williams valley, 30 miles. The line is being built to carry lumber, fruit, ore and agricultural products. A. D. Bowen, president, Spalding building, Portland; J. E. Gardner, chief engineer, Grants Pass.

HAWKINSVILLE & WESTERN.—An officer writes that this company is building from Hawkinsville, Ga., northwest via Browndale to Perry, 22 miles. Grading has been finished on about 12 miles. The work is being carried out by day labor and section work. There will be one steel bridge, 100 ft. long, and about 1,200 ft. of trestle work. The line is being built to carry cotton, farm products and live stock. T. B. Ragan, president, and J. J. Gilline, chief engineer, Hawkinsville. (February 24, p. 368.)

KANSAS, OKLAHOMA & PANAMA.—An officer is quoted as saying that construction work will be started in the near future south through Elk City, Okla., Port, Carter and Sentinel to Mangum. The company already has a section built from Mangum south towards the Red river. F. A. Mosher, secretary-treasurer, Port, Okla. (February 3, p. 256.)

KENTUCKY-TENNESSEE TRACTION.—An officer writes that contracts are to be let early this spring to build from Hopkinsville, Ky., southeast via Salubria Springs, Pembroke and Trenton to Guthrie, on the Louisville and Nashville about 25 miles. There will be three steel bridges and one overhead railway crossing. Plans are made to put up a power house and substations. The Arnold Co., Chicago, are the engineers. Charles Vanden Burgh, general manager, Hopkinsville. (October 28, p. 810.)

KOOTENAY CENTRAL.—See Canadian Pacific.

LARAMIE, HAHN'S PEAK & PACIFIC.—According to press reports, financial arrangements have been made to extend this line from Fox Park, Wyo., across northwest Colorado into eastern Utah.

LICKING RIVER.—An officer writes that the plans call for a line from Yale, Bath county, Ky., southwest along Beaver creek, via Scranton to Frenchburg, in Menifee county, about 12 miles. Contracts are to be let in March for some of the work. Seven miles has been finished and is now in operation. There will be a 40-ft. steel bridge, also a station building at Frenchburg. J. H. Fulmer, Jr., president, and J. O. Johnson, general manager, Yale.

MADISON COUNTY.—An officer writes that half the work is finished on a 10-mile line which the company is building with its own forces from Union, N. C., to Allenstand. The work is difficult, being mostly mountain work. The line is being built to carry lumber, minerals, iron ore, etc. A. G. Betts, president; Stackhouse and W. N. Garrett, engineer, Hot Springs.

Midland Pennsylvania.—This company, which was incorporated in Pennsylvania in February, 1910, is building a line from Millersburg, Dauphin county, Pa., northeast via Killinger, Berrysburg, Gratz, Sacramento, Valleyview, Hegins, and Mabel to Ashland, Schuylkill county, 44 miles, over a private right-of-way, 60 ft. wide. There will be about 10 miles of sidings. W. E. Harrington, president; J. H. Williams, secretary, Pottsville. (September 23, p. 558.)

New Orleans, Mobile & Chicago.—An officer is quoted as saying that the company is planning to begin construction work at once on an extension north towards the Ohio river.

Oklahoma Roads.—Plans are being made to build from Chickasha, in Grady county, Okla., west to Anadarko, thence northwest via Weatherford to Woodward, about 140 miles. James Gordon, Atlanta, Ga., is the principal promoter.

Oregon Trunk.—Announcement is made that this company has started freight and passenger traffic over this line, from Clarke, Wash., on the north side of the Columbia river, south to Madras, Ore., 115 miles, through the Des Chutes valley, providing a direct line into Oregon in connection with the Spokane, Portland & Seattle, as well as making about 5,000,000 acres of government land immediately accessible. The line is to be eventually extended south to Bend.

Oregon-Washington Railroad & Navigation Company.—Trains are now in operation on four miles of the relocated main line between Portland, Ore., and Yoakum, and the remaining 12 miles will be opened for traffic soon. The bridge at Coe was completed recently, as well as the 543-ft. tunnel at that place, and a 400-ft. cut at the east end. The new line is over a mile shorter than the old line and eliminates the horseshoe curve.

Pecos Valley & Northeastern.—See Atchison, Topeka & Santa Fe.

Pueblo & Southeastern.—An officer writes that a contract has been given to Joe Nix, Pueblo, Colo., to build 3.5 miles of line between Pueblo and the Atchison, Topeka & Santa Fe and Missouri Pacific at Nepesta. The work will involve handling about 5,000 cu. yds. a mile. Maximum grades will be 0.3 per cent., and maximum curvature 1.5 deg. There will be 575 ft. of trestle on this line. Additional contracts are to be let at once for work on the line, which is to have a total length of 50 miles. B. H. Tallmadge, president, Topeka, Kan.

Scott City Northern.—See Garden City, Gulf & Northern.

Stephenville, North & South Texas.—An officer writes that grading work is nearing completion on the extension from Hamilton Junction, Texas, which is 5.5 miles north of Hamilton, via Gustine, to Comanche, 31.5 miles. The work includes a number of steel bridges and three trestles. Brick passenger stations are to be put up at Lamkin and at Comanche. The line is being built to carry cotton, agricultural products, live stock and merchandise. Thompson & Scott, St. Louis, Mo., are the contractors. (October 7, page 674.)

St. Louis, Peoria & North Western.—See Chicago & North Western.

St. Louis, El Reno & Western.—See Fort Smith & Western.

St. Louis & San Francisco.—Announcement is made that the extension from Brady, Tex., southwest to Menard, 37 miles, has been finished and regular freight and passenger service is now in operation.

Uintah Railway.—According to press reports, this company will start work soon on a nine-mile extension in eastern Utah and western Colorado, northeast towards White river. An officer is quoted as saying that the existing 54-mile line from Mack, Colo., northwest to Dragon, Utah, will be made standard gage and that some heavy work will be carried out eliminating the grades.

Union Pacific.—A contract has been let for building a 50-mile section of the Laramie cut-off from Northport, Neb., northwest to Gering, paralleling the Chicago, Burlington & Quincy tracks. This extension will eventually be built to a connection with the present main line near Medicine Bow, Wyo., and will form part of the through route, considerably reducing the grades of the Omaha-Ogden line.

Railway Financial News.

Cairo & Thebes.—This road is to be leased to the St. Louis, Iron Mountain & Southern at an annual rental of 4 per cent. on the $2,000,000 bonds. The road runs from Cairo, Ill., to a bridge across the Mississippi river at Thebes, 25 miles. It was built by what was understood to be an independent company, although it was rumored that the road would be leased to the Louisville & Nashville. The passenger and freight terminals at Cairo are of standard modern construction.

Chicago, Rock Island & Pacific.—Speyer & Co., New York, are offering $10,000,000 or £2,000,000, St. Paul & Kansas City Short Line first mortgage 4½ per cent. bonds, due 1941, at 93½, yielding 4.90 per cent. income. Roberts Walker, chairman of the executive committee, says in part:

"The new railway company has contracted to acquire substantially all of the stock and bonds outstanding of St. Paul & Des Moines, which operates a line from Des Moines northward to Mason City, Iowa, connecting with the Chicago-St. Paul line of the Chicago, Rock Island & Pacific, and will build from Allerton, on the Chicago-Kansas City line of the Chicago, Rock Island & Pacific, northward to Carlisle, near Des Moines, with the right to operate from Carlisle into Des Moines, including terminals at that city. The "Short Line" will give the Rock Island lines the shortest and most direct line between Kansas City and the so-called "Twin Cities" of St. Paul and Minneapolis, will traverse a well-settled agricultural country and will open large coal fields in Lucas and Marion counties, Iowa, reducing the fuel cost of the Rock Island lines and furnishing valuable traffic."

Cincinnati, Hamilton & Dayton.—This company has sold to J. P. Morgan & Co. 110,000 shares of the common stock of the Pere Marquette Railroad Co.

The transaction includes arrangements for financing substantial improvements to the Pere Marquette Railroad to be commenced at once. In that connection the Pere Marquette Railroad Co. has authorized and will issue $8,000,000 of five-year 6 per cent. notes under collateral indenture, the notes being secured by the deposit of $16,000,000 of 50-year 5 per cent. bonds, issued under an improvement and refunding general mortgage.

Cleveland, Cincinnati, Chicago & St. Louis.—The directors at their monthly meeting have taken no action toward declaring a dividend on the $47,056,300 common stock. In 1908, 1 per cent. was paid; in 1909, nothing; in 1910, 4 per cent.

Erie Railroad.—J. P. Morgan & Co., New York, have bought the entire issue of $12,500,000 three-year notes of the Erie, recently authorized by the New York Public Service Commission.

Norfolk Southern.—The stockholders have authorized an increase in the issue of bonds from $12,000,000 to $35,000,000. The capital stock of $16,000,000 will remain unchanged. Of the old authorized $12,000,000 bond issue, there are outstanding $5,780,000, with $3,220,000 reserved to retire underlying securities.

The United States Circuit Court has discharged the receivers of the Norfolk & Southern Railroad.

Pere Marquette.—State Railroad Commission of Michigan has authorized the Pere Marquette to issue $8,000,000 five-year 6 per cent. notes, of which amount, it is stated, $2,500,000 will be used for improvements and extensions. See also Cincinnati, Hamilton & Dayton.

Pittsburgh & Lake Erie.—Officers are quoted as saying that the company is contemplating an issue of $4,200,000 additional stock. Formal action on such a proposition is expected in the near future.

Southern Pacific.—Kuhn, Loeb & Co., New York, have made arrangements for the sale to a syndicate of French banks, of 250,000,000 francs ($50,000,000) of Central Pacific 4 per cent. 35-year bonds. These bonds are guaranteed by the Southern Pacific Company and will be issued in denominations of 500 francs each.

St. Louis, Iron Mountain & Southern.—See Cairo & Thebes.

Supply Trade Section.

The Cincinnati Car Company, Cincinnati, Ohio, has increased its capital from $100,000 to $1,500,000.

The Buckeye Mfg. Co., Alliance, Ohio, has increased its capital stock from $30,000 to $50,000, fully paid.

The Chicago Bearing Metal Company, Chicago, has increased its capital stock from $250,000 to $500,000.

William B. Mason, president of the Mason Regulator Company, Boston, Mass., died on Saturday, February 4.

The Ohio Seamless Tube Company, Shelby, Ohio, has increased its capital stock from $350,000 to $1,000,000.

The Rail Joint Company, New York, has moved its Chicago office from the Monadnock block to the Railway Exchange.

The Chicago Pneumatic Tool Company, Chicago, at the meeting of the board of directors, February 20, re-elected the retiring directors with the exception of J. W. Duntley, who is succeeded by J. H. Ward. Mr. Duntley has retired to engage in other business.

The Railway Steel-Spring Company, New York, at the recent meeting of the board of directors elected the following to membership on the board: H. K. Devereux, succeeding Julius E. French; George B. Motheral, succeeding Philo N. French, and Charles Scott, Jr., succeeding George G. McMurtry.

Percival Roberts has been elected a member of the finance committee, of the United States Steel Corporation, succeeding W. E. Corey. Mr. Roberts was president of the American Bridge Company, New York, when it was taken over by the steel corporation. He was elected a member of the board of directors, but resigned in June, 1902.

The employees of the Yueh-Han Railway, China, are organizing a railway club, and with it a library. For this purpose catalogs of all sorts of railway supplies, and more particularly of rolling stock and shop equipment are desired. E. C. Chang, assistant storekeeper of the Yueh-Han Railway, 32 Fung Yuen Ching street, Canton, China, may be addressed.

The annual report of the Union Switch & Signal Company, Swissvale, Pa., for the year ended December 31, 1910, shows gross sales of $6,256,824, an increase of $3,645,168 over 1909. The total income was $6,259,093, an increase of $3,633,960 over 1909. The balance for dividends was $1,231,507, an increase of $905,525 over 1909. The dividends were $299,784, an increase of $612 over 1909, and the surplus was $931,723, an increase of $904,913.

The Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has let contracts to the American Bridge Company, Pittsburgh, Pa., for 3,000 tons of structural steel to be used in building two new foundries at Trafford City. Work will be begun within a few weeks. The Westinghouse company has bought 30 acres near Trafford City, and it is planned to have all castings for the various Westinghouse companies produced at these foundries.

Louis A. Shepard, formerly vice-president and general manager of the Titan Steel Castings Company, Newark, N. J., with which company he was connected for seven years, has opened a sales office at 30 Church street, New York, room 517, and will make a specialty of handling railway timber, including cross ties, cross arms, piling, poles, etc. Previous to his connection with the Titan Steel Castings Company, Mr. Shepard was chief engineer for Cornelius Vanderbilt.

The new fiscal year of the Western Electric Company, Chicago, began with January. The earnings for that month were slightly in excess of January, 1910, in spite of the fact that in December every effort was made to clean up orders on hand, in order to make the carry-over as small as possible. The company is in a strong financial position and will be able to continue its policy of concentration at Hawthorne, Ill., this year, without incurring further funded obligations.

The Hayes Track Appliance Company, Geneva, N. Y., has bought ground at Richmond, Ind., where it is building a factory. It is the intention to close the Geneva plant and occupy the new one about April 1. This change is made to secure a location nearer the center of demand. The company has recently secured a standardization contract with the Harriman lines for Hayes derails, and in addition to other large orders in this country has secured a promising export trade, especially in South Africa, India and Australia.

M. H. Westbrook, foreman of the Grand Trunk shops at Battle Creek, Mich., who was awarded the first prize in the *Railway Age Gazette* shop kink competition which closed January 15, has accepted a position with Joseph T. Ryerson & Son, Chicago. The esteem in which Mr. Westbrook was held by the employees at the Battle Creek shops was shown by a farewell reception, which was given him by 500 of the employees, when they presented him with a handsome gold watch and chain, a Masonic fob and a traveling bag.

The Boss Nut Company, Chicago, announces that it has acquired from the B. M. Osbun Company, Chicago, complete rights to the Boss nut. The Boss nut has been used on the equipment of 46 large railways and 52 smaller railways and private car lines, and has also been widely used on special crossing work. Several companies manufacturing frogs and crossings are now using the Boss nut as standard. The officers of the company are: President, Charles Gilbert Hawley; vice-president and treasurer, B. M. Osbun; secretary, John R. Lefevre.

The General Electric Company, Schenectady, N. Y., has received orders from the New York Central & Hudson River for the following apparatus, for the extension of electrification to Irvington, on the Hudson division: Four 2,000-kw. rotary converters of the commutating pole type, 12 735-kw. 11,000 volt transformers, two 20,000 cu. ft. per m. blower sets. Three of these rotaries with their step down transformers and the blowers will be installed in the new substation now in course of construction at Irvington, while the remaining one with transformers will be installed in the substation at Yonkers.

The Nickel-Chrome Chilled Car Wheel Company, Newark, N. J., was incorporated on February 23. The officers of this company are as follows: President and treasurer, Robert C. Totten; vice-president and general manager, Stephen D. Barnett; secretary, Charles A. Millington. The New York office of the company is in the Hudson Terminal building, and the Pittsburgh, Pa., office is in the Frick Annex. The purpose of the company is to furnish nickel chrome alloy to makers of chilled car wheels. It is claimed that, on a mileage basis, the cost of nickel chrome wheels is but one-fourth that of steel wheels and one-half the cost of cast iron wheels.

The annual report of the Lackawanna Steel Company, New York, and subsidiaries, for the year ended December 31, 1910, shows gross sales of $31,302,760 as compared to $25,296,661 in 1909. The net income from manufacturing and operating was $6,330,470 in 1910, and $4,709,823 in 1909. The balance in 1910, after fixed charges was $2,533,105, or 7.25 per cent. on the capital stock, as compared with $778,109, or 2.2 per cent. on the capital stock, in 1909. Compared with 1907, the best previous year in the history of the corporation, the shipments show an increase of 9.15 per cent., and the balance after fixed charges shows an increase of $89,259, or 3.65 per cent., notwithstanding the fact that the average prices of 1910 were 4.36 per gross ton, or 13.1 per cent. less than those of 1907.

The properties of the Hicks Locomotive & Car Works, Chicago, consisting of the entire plants of the company at Chicago Heights, Ill., the good will and all the assets, were sold by William McInnes, trustee of the Hicks Locomotive & Car Works, in bankruptcy, to William Barbour of New York, on February 21. Mr. Barbour is president of the Linen Thread Company, New York, and a director of the Hanover National Bank. He and his associates have now effected an organization to be known as the Central Locomotive & Car Works, with office in the Fisher building, Chicago, which has succeeded to the business of the Hicks Locomotive & Car Works. William McInnes, who with F. M. Hicks, founded the Hicks Locomotive & Car Works, will

actively direct the policies of the new company as president and general manager. A. M. Gardner, the vice-president, was formerly connected with the Linen Thread Company. Mr. Barbour will be treasurer. C. B. Bruce, the secretary, has been with the Hicks company as assistant superintendent at the works for the past ten years. He will be assistant superintendent at the works at Chicago Heights. A. M. Hicks, formerly of the Hicks Locomotive & Car Works, will be the purchasing agent of the new company, with headquarters at Chicago. The Central Locomotive & Car Works will make a number of substantial improvements in the two plants at Chicago Heights, consisting of new machinery and shop tools. It will make a specialty of new coaches, new freight equipment, rebuilt passenger cars, freight cars and locomotives.

Robert Mather, chairman of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., referring to the seizure of the books of the Russian Westinghouse company in St. Petersburg on February 23, by the police, said: "The Westinghouse Russian company had a contract for the electrification of tramways at St. Petersburg. That contract was completed something more than a year ago. In the course of the execution of the contract the municipality withheld from time to time sums of money which it called 'fines' on account of alleged delays by the Russian company in the performance of the work under the contract. The Russian Westinghouse company claims, on the other hand, that those delays had been caused by the municipality itself or by other contractors or other causes for which the Russian company was not responsible. A claim has been pending before the municipal council of St. Petersburg for the payment of those withheld amounts. That claim is at the present time in process of investigation by a committee of the municipal council. So far as the business of the Russian Westinghouse company is concerned, this reported action can have no effect at all, because not only the factory but the general office and staff and all of the affairs relating to the business of the Russian company are in Moscow and not in St. Petersburg." A cablegram later received from Mr. McCarter, manager of the St. Petersburg branch of the Westinghouse Electric & Manufacturing Company, to the New York office said: "Our position satisfactory. All companies having large contracts with municipalities have had their books and papers taken for investigation by a special commission appointed by the government."

TRADE PUBLICATIONS.

Switch Box.—Bulletin No. 121 of the General Railway Signal Company, Rochester, N. Y., is an illustrated folder describing the universal switch box model 5, form A.

Electric Railway.—The Stone & Webster Engineering Corporation, Boston, Mass., has published a 12-page illustrated booklet on the Seattle-Everett Electric Railway, built by it in Washington. This is a reprint of an article which appeared in the *Electric Railway Journal.*

Tramrails; Furnaces.—The Rockwell Furnace Company, New York, in bulletin T illustrates the advantages of the Moyer tramrail in modern foundry practice. Bulletin 27 of this company argues the superiority of gas and oil-burning rivet heating furnaces over the coal and coke-fired forge.

Corrosion-Resisting Metal.—The Canton Culvert Company, Canton, Ohio, has published a useful little booklet on No-Co-Ro metal. This booklet is an interesting treatise on corrosion and its causes, and includes the results of some tests which show the superiority of No-Co-Ro metal over ordinary iron and steel in purity, homogeneity and resistance to corrosion.

Coal.—The American Locomotive Company, New York, has issued bulletin No. 1008, giving the classification, analysis and comparative heating values of different grades of coal. This bulletin is a condensed report of tests made by the United States Geological Survey at the fuel testing plant at St. Louis, Mo., and is compiled with the idea of making a handy reference for railways.

RAILWAY STRUCTURES.

Bellingham, Wash.—The Northern Pacific is planning to put up a large station at Bellingham.

Berkeley, Cal.—The Southern Pacific is asking for bids for putting up a power station at Berkeley, to be used in connection with the electrification of its lines in that section.

Burlington, Vt.—An officer of the Central Vermont is quoted as saying that plans have been made for building a new passenger station and a new freight house at Burlington. It is understood that the improvements will cost about $75,000.

Calgary, Alb.—The Canadian Pacific is said to have bought land at Calgary as a site for a hotel, to cost $250,000.

Cascade, Mont.—The Great Northern station at Cascade has been destroyed by fire.

Comanche, Tex.—See Stephenville, North & South Texas, under Railway Construction.

Farmington, N. Y.—The New York Public Service Commission, Second District, has ordered the elimination of the present grade crossing of the Lehigh Valley at the Manchester-Victor road in the town of Farmington, Ontario county. The highway is to be carried over the tracks on a steel superstructure, to have a clearance above the top of the rail of not less than 22 ft., with proper approaches. A temporary crossing is to be maintained during the construction of the overhead crossing and approaches. The viaduct will cover a space sufficient for six tracks. The present line has but two tracks, and the excess in cost to span six tracks is to be paid for by the Lehigh Valley. The work will cost about $70,000.

Frenchburg, Ky.—See Licking River, under Railway Construction.

Kelso, Wash.—The Northern Pacific has plans made for putting up a new station at Kelso.

Lamesa Springs, Cal.—The San Diego & Cuyamaca is said to have plans made for putting up a new passenger station at Lamesa springs.

Letha, Idaho.—The Payette Valley has had plans made for building a station at Letha.

Los Angeles, Cal.—The Southern Pacific will spend $500,000, it is said, for improvements to its shops and to the shops of the Pacific Electric, at Los Angeles. This includes an additional building, to cost $100,000, on which work is to be started at once.

Medford, Ore.—The Oregon Trunk has secured land to be used as a site for a station, also for a freight house at Medford. The construction work will be started at once.

New Haven, Pa.—Plans are being made by the Pittsburgh & Lake Erie and the Western Maryland to jointly build a stone and brick passenger station, 38 ft. x 100 ft., at New Haven. The cost of the building will be about $50,000.

North Pomona, Cal.—The Atchison, Topeka & Santa Fe Coast Lines will enlarge and improve the passenger station at North Pomona.

Pasadena, Cal.—The Atchison, Topeka & Santa Fe Coast Lines, it is said, will build an addition to its passenger station at Pasadena.

Pecos, Texas.—Local press reports state that plans and specifications for a $30,000 passenger station have been prepared by the Texas & Pacific.

Portland, Ore.—The Oregon Trunk Railway has let contracts for the steel bridges on that line as follows: The American Bridge Company and the Pennsylvania Steel Company under separate contracts will supply manufactured steel for all bridges, including the one over the Columbia river. Porter Brothers, Portland, Ore., have the contract for the substructure of the Columbia river bridge, and Bates & Rogers, Chicago, for the sub-structure of all other bridges. The Missouri Valley Bridge & Iron Company, Leavenworth, Kan., has the contract for the erection of all steel.

Ripon, Wis.—The Chicago, Milwaukee & St. Paul will put up a new passenger station at Ripon, to cost $10,000.

Salem, Ore.—The Salem, Falls City & Western has asked for permission to build a bridge over the Willamette river at Salem, to cost $100,000.

Seattle, Wash.—The Columbia & Puget Sound will build a bridge, it is said, over the Black river.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Long Island has ordered 2 switching locomotives from the Baldwin Locomotive Works.

The Bingham & Garfield has ordered 1 Mallet locomotive from the American Locomotive Company.

The Southern Railway is in the market for 25 mikado locomotives, 15 Pacific type locomotives and 15 switching locomotives.

The New York, Chicago & St. Louis is said to have ordered 25 mogul locomotives from the American Locomotive Company. This is not yet confirmed.

CAR BUILDING.

The Western Maryland is in the market for 500 coal cars, and is rumored to be making inquiries for 25 passengers cars.

The Southern Railway is in the market for 35 first class coaches, 20 postal cars and 10 combination passenger and baggage cars.

The Northern Pacific is not in the market for 18 wooden passenger cars as mentioned in the *Railway Age Gazette* of February 24. This is a part of the inquiry of the Spokane, Portland & Seattle mentioned in the issue of February 3.

The Cuban Railway has placed orders with the American Car & Foundry Company for 100 flat cars, 50 box cars, 3 sleepers, 2 first-class coaches, 6 second-class coaches, 3 baggage cars and 1 inspection car.

The Atlantic Coast Line has ordered 25 coaches and 4 combination passenger and baggage cars from the Pullman Company. This line is in the market for from 1,200 to 1,400 steel underframe box cars, 100 steel underframe flat cars and 50 steel underframe phosphate cars.

The Escanaba & Lake Superior has ordered fifteen 40-ton, 41-ft. flat cars, as mentioned in the *Railway Age Gazette* of February 24. The order was placed with the National Railway Equipment Company, Chicago, instead of the Ryan Car Company, as stated in the previous mention.

IRON AND STEEL.

The Southern Railway has ordered 1,800 tons of 85-lb. rails from the Illinois Steel Company.

The Cleveland, Akron & Columbus has ordered 2,000 tons of rails from the Carnegie Steel Company.

The Oakland Traction Company, Oakland, Cal., has ordered 1,000 tons of rails from the Pennsylvania Steel Company.

The Pan American of Uruguay has ordered 45,000 tons of 65-lb. rails from the United States Steel Products Company.

The Bangor & Aroostook, mentioned in the *Railway Age Gazette* of February 17 as being in the market for 13,000 tons of rails, has ordered 13,500 tons of rails from the Pennsylvania Steel Company.

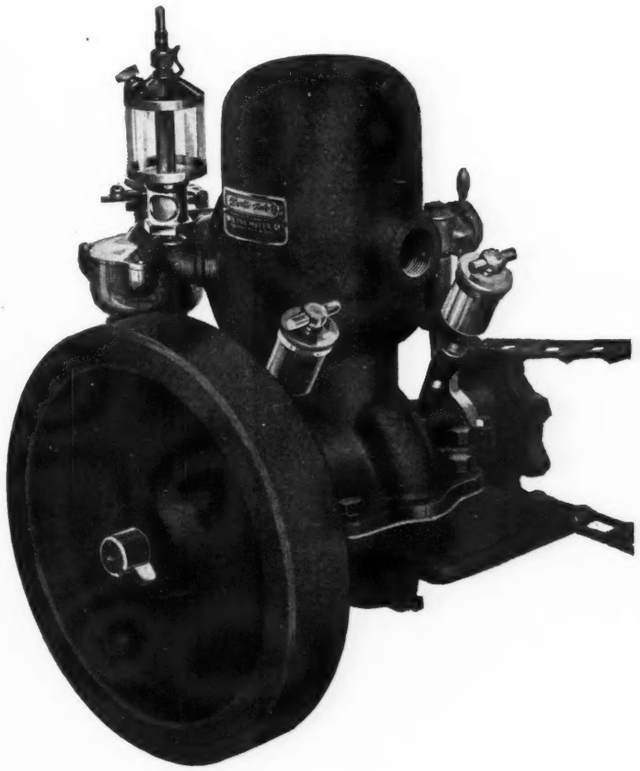
General Conditions in Steel.—The falling off in orders since the rate decisions has been very slight, and it appears that even this depression is only temporary. Orders for what the roads need will not be held up any longer. The daily bookings of the United States Steel Corporation during February were between 35,000 and 40,000 tons, as compared with 30,000 tons in January. This means that the corporation is now operating at a larger percentage of its capacity than at any time since early last summer. The prices have not gone up with the increase in orders. One of the reasons for this is the recent over production. It was made known, however, that the prices might be raised at any moment, and the result was that the buying movement was immediately stimulated. The export business is still responsible for a large share of the daily bookings, and it is interesting to note that the only equipment order of even a moderate size, placed last week, was for a foreign road.

SIGNALING.

The Buffalo, Rochester & Pittsburgh has ordered from the General Railway Signal Company, Rochester, N. Y., equipment for automatic block signals on 35 miles of its line from Clarion Junction, Pa., north of Johnsonburg, south to Falls Creek, Pa. This line is double track throughout. The signals will be three-position semaphores, the arms moving in the upper quadrant.

A Velocipede Motor.

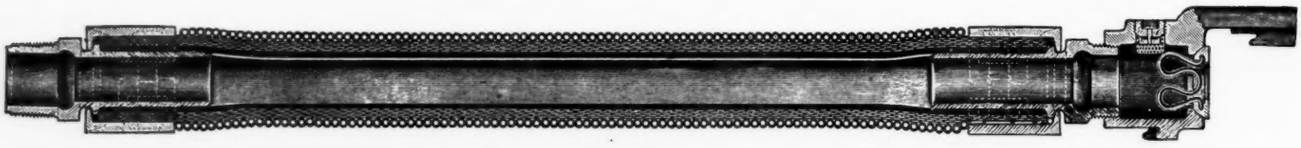
The Concrete Form & Engine Company, Detroit, Mich., is manufacturing a small gasolene engine which may be easily applied to velocipede cars; the price is so low that it is being used by signal men and track foremen, who equip their cars for power in this way at their own expense. The cost of a 2½-h. p. gasolene engine, including accessories, is $49.15. The engine, which is here illustrated, measures 11¼ in. high from center of the crank shaft, and weighs only 73 lbs. It will drive a car from 5 to 30 miles per hour and uses one pint of gasolene per h. p. hour. It will also operate with kerosene or alcohol. The engine is strong and durable, as has been proved by its use in motor boats and velocipedes which have been equipped with it during the past few years. In its application to rail velocipedes a sprocket is keyed and fastened to the outside of one of the drive wheels of the car, and is driven by a chain from a sprocket on the motor. Blueprints and complete instructions to show the proper method of installation are furnished with each engine.



Gasolene Engine for Velocipede Cars.

Steam Hose and Coupling for Cars.

An altogether new and practical steam hose and coupling, as shown in the accompanying illustrations, has been designed and patented by Edward E. Gold, president of the Gold Car Heating & Lighting Company of New York. It was designed to meet the conditions of the present improved train service, and is not only durable, reliable and strong, but may be considered as a safety appliance as well. The hose is 5-ply, bound around by covered wire, which makes it stronger than the ordinary 8-ply hose. It is easier handled by the trainmen, the wire not materially affecting its pliability. The wire also gives it a protection from being cut or chafed not found in ordinary hose, and prevents any undue swelling from high pressure steam. The hose is clamped to the nipples by a two-piece clamp especially designed to withstand the high pressures.

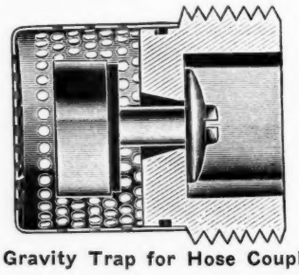


Gold Wire Wound Steam Hose.

Gold Improved Steam Hose Coupling.

The coupling is an improvement on the Gold coupling now used with the addition of a device which gives a positive lock to the connection after it is coupled, preventing vibration from working it loose. This lock is simply a curved piece of round iron held in a bearing on the coupler by a split pin on one side and flatened projection on the other. In this projection, and off the center line of the bearing, is located a thumb screw, which when turned bears on the coupling and rotates the round iron in its bearing, bringing the curved end hard down on the opposite half of the coupling, and holding it in place.

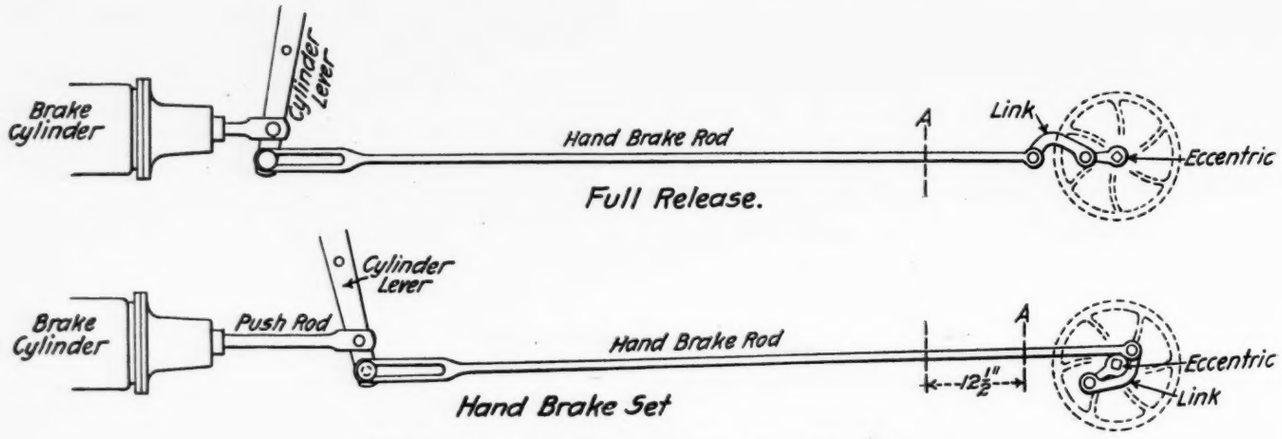
An improvement to the gravity steam trap is also included in this coupling and is shown in the accompanying illustration. It consists of a small valve with a fiber disc on its under side, which seats against the outlet as soon as the steam pressure is turned on. This outlet is cut conical, so that when there is no pressure the valve will fall from its seat and allow the water to drain from the hose and coupling. Dirt is prevented from obstructing the trap by the strainer shown. This trap not only serves to drain the coupling and keep it from freezing, but also may be used by the trainman to ascertain if the steam is shut off before he uncouples the hose, thus eliminating danger of scalding. A steam tight joint is maintained in the coupling by two gaskets made of vulcalebston, which have ball joint seats insuring a perfect connection.



Gold Gravity Trap for Hose Coupling.

Burdette Chainless Hand Brake.

A new hand brake rigging designed to take the place of a chain on the brake staff is shown in the accompanying illustration. It consists of a short lever, marked "eccentric" with a square hole which fits on the brake staff and is secured to it by a dowel pin. The other end is connected to a curved link by a pin. This link operates the hand brake rod, which is connected to the cylinder lever by a pin working in a long slot. The upper view shows the hand brake in full release with the eccentric and link in line with the brake rod. The revolution of the brake wheel causes the eccentric to wind the link about the brake shaft, the hand brake rod moving 12½ in.



Application of the Burdette Chainless Hand Brake.

When the air brake is set the pin connecting the cylinder lever to the brake rod slides forward in the slot without moving the rod, and when air is released it returns to the end of the slot again, there being no slack, as in chain-connected brake rigging. The brake staff stirrup is dispensed with as a winding

bearing on the staff is not required, and the brake staff can be made shorter. The device has been successfully tested in railway service, and special designs are made for its use on street railway cars. The forgings for the chainless hand brake are supplied by the Pacific Railway Supply Company, Great Northern building, Chicago, the general offices of the company being in the Pacific Electric building, Los Angeles, Cal.

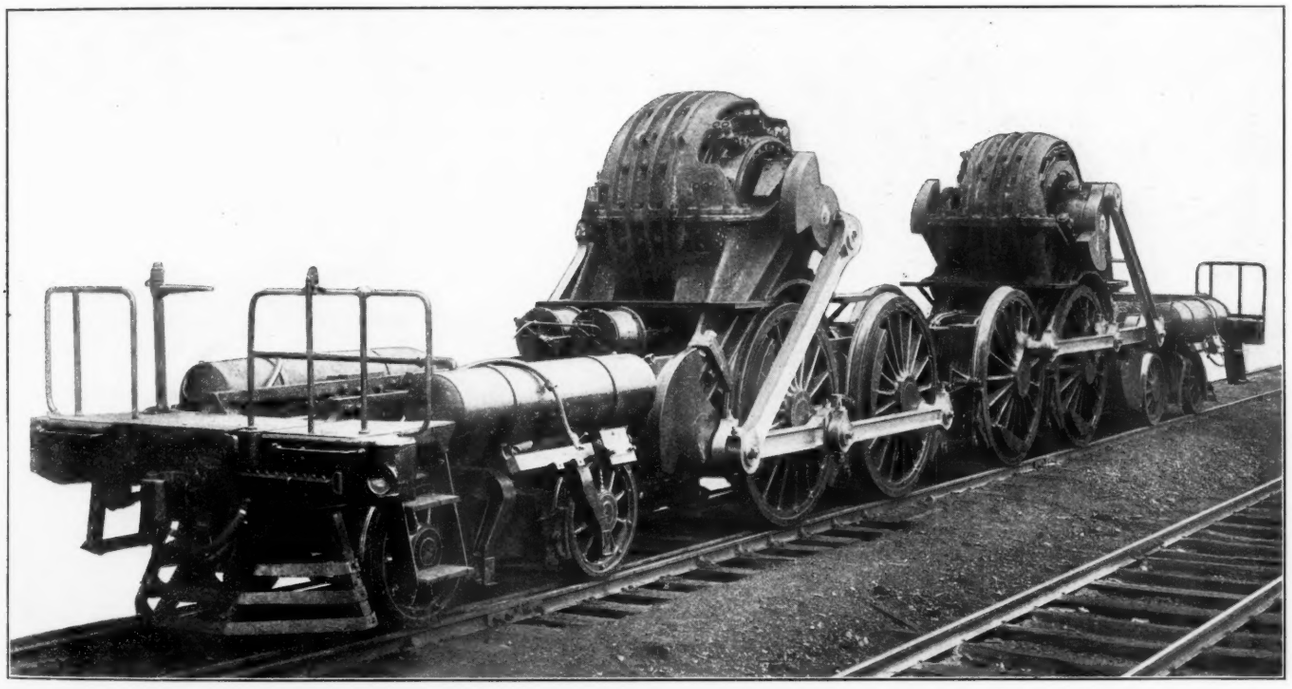
Electric Locomotives for the Pennsylvania.

The Pennsylvania Railroad has ordered nine more direct current, 600-volt, electric locomotives, aggregating about 40,000 horse-power, from the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., which are to be completed by July 1, 1911. The new locomotives will be of the same type as those which are now being operated in the Manhattan Terminal, New York, and will supplement the 24 already in use. The cabs, frames, running gear and mechanical parts will be built by the Pennsylvania Railroad at its Juniata shops. The air brakes will be supplied by the Westinghouse Air Brake Company; the electrical equipments will be built and the complete locomotives assembled at the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company. These are the most powerful electric locomotives ever built. They are articulated, of double cab design, each half carrying its own motor and complete equipment, and are coupled together at their driving-wheel ends. The frames, driving wheels and trucks of the running gear are similar in general character to those of an American type steam locomotive.

Each cab is provided with the Westinghouse automatic and straight air brake equipment, apparatus for train lighting, electric head lights, pneumatically operated whistle and sanders, as well as its motor unit switches and master controller. The coupled ends are fitted with permanent couplings of twin draw bars and Westinghouse friction draft gears, so arranged that the leading half serves as a leading truck and the other half as a trailer in whichever direction the locomotive may be moving. The wheel and motor arrangement was selected only after careful experiments with several other forms, the governing motive being to secure the greatest possible steadiness at high speed. The machines are so arranged that in event of one motor being cut out, the entire machine may be operated from either cab with the remaining motor. The halves are interchangeable, and if one is out of service it may be replaced by another half while repairs are being made. The unit switch field control permits two or more locomotives to be coupled together and all to be operated from either end of any one cab, and affords flexibility of speed regulation. It gives two additional running notches, and at the same time economizes power consumption during acceleration. These locomotives are designed to start and accelerate a 550-ton train on 2 per cent. grades. The following are some of the principal dimensions:

Weight of locomotive, complete	156 tons.
Weight on drivers	200,000 lbs.
Weight on each driving axle	50,000 lbs.
Weight on each truck	57,000 lbs.
Total length overall, inside knuckles	64 ft., 11 in.
Rigid wheel base of each half	7 ft., 2 in.
Total wheel base of each half	23 ft., 1 in.
Total wheel base of locomotive	55 ft., 11 in.
Diameter of drivers	72 in.
Contract tractive effort	60,000 lbs.
Maximum drawbar pull (recorded on test)	79,200 lbs.
Normal speed with full train	60 mi. per hr.
Frames	Cast steel.
Motors	D. C. Interpole.
Weight of each motor complete with cranks	43,000 lbs.
Height of motor frame above cab floor	5 ft., 6½ in.
Height of center of shaft above cab floor	2 ft., 1½ in.

Since the opening of the Manhattan Terminal on November 27, 1910, all through passenger trains of the Pennsylvania have been handled through the tunnels by electric locomotives of this type without a hitch and to the entire satisfaction of the operating force. Heavy trains, far beyond the capacity of the usual passenger locomotive, have been handled over the tunnel grades with ease.



Electric Locomotive with Cabs Removed; Pennsylvania Railroad.

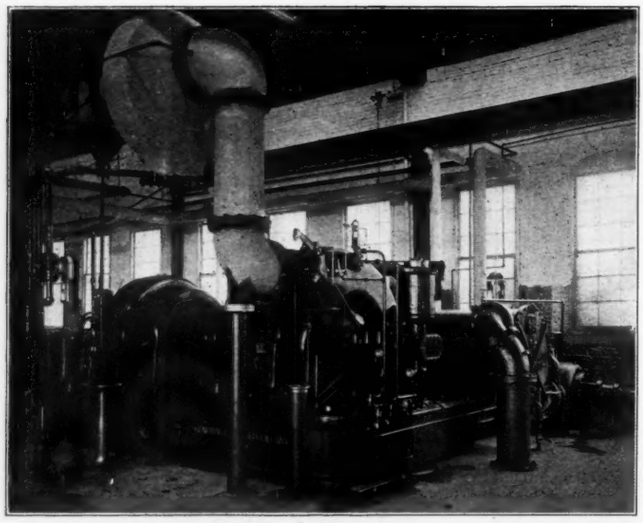
Low-Pressure Turbine for the Bettendorf Axle Co.

BY P. BENDIXEN, Master Mechanic.

About two years ago the Bettendorf Axle Company, of Davenport, Iowa, made a thorough investigation of the various prime movers suitable for an addition to its power plant. The power equipment at that time consisted of two 100 k.w. direct-connected, high speed, tandem compound, engine-driven units, a number of hydraulic pumps, and an air compressor, all exhausting into one header, making an ideal arrangement for connection to an exhaust turbine. Taking into consideration the heating of the shops in winter and the fact that the old power plant was running non-condensing, it was decided to install a 500-k.w. horizontal low pressure Curtis turbine built by the General Electric Company of Schenectady, N. Y. This was put in operation in September, 1909, and has been in service about fourteen hours a day since. It supplies all electrical power required by the plant, which at present amounts to 250 k.w. aver-

age load; this power is used mostly for the operation of cranes, the lighting of shops and for lifting magnets.

Although the turbine is fed from the exhaust of the prime movers, an auxiliary live steam supply is provided through a 4-in. by 8-in. Foster pressure-reducing valve in case the exhaust steam supply should be shut off or be reduced. This arrangement works satisfactorily, as the valve operates within a range of one-half pound drop in pressure. The average back pressure is about three pounds, and to take care of an excessive back pressure the exhaust header is provided with a 12-in. relief valve set to operate at five pounds pressure. All steam to the turbine passes through an 18-in. two stage separator, which



Curtis 500 K. W. Low-Pressure Turbine for the Bettendorf Axle Company.

separate all oil and moisture from it. A 3,150-ft. Worthington condenser is installed, the condensed steam being returned to the boiler feed water heater. While no data are available to substantiate a statement as to the exact performance of the turbine, it is thought that when running with a 28-in. vacuum, 75 per cent. of the energy delivered to the pumps, compressors, and reciprocating engines is recovered. In cool weather it has been possible to run for weeks with a vacuum of from 29 to 29½-in.; this, of course, makes quite a difference in the steam consumption. In order to maintain a good vacuum, it has been found necessary to pipe the steam seal in which the carbon packing rings are located with high pressure steam to insure against any leakage of air around the shaft. The amount of steam required for this purpose can best be found by experiment, and when once adjusted requires little attention.

Before putting the turbine in service it was run for a few days under various loads, the generator being loaded on a water box. It was found that sufficient exhaust steam was available to furnish 425-k.w. continuously and as much as 575-k.w. for short periods. Six boilers of about 120-h.p. each were in service at that time. The results of the test would indicate that 75 to 80 per cent. of the energy delivered to the engines and auxiliaries was recovered.

The governing of the turbine is good, as with a load fluctuation of about 500 amperes the variation in potential does not exceed two or three volts. The lighting load consists of enclosed arc, flame arc, mercury vapor and incandescent lamps, all of which show up much better when operated by the turbine than when the engine-driven units carry the load. This improved performance is due to the better regulation of the turbine. The emergency governor is tested regularly once a week; it has never failed to respond to an increase in speed, invariably tripping the stop valve on the turbine.

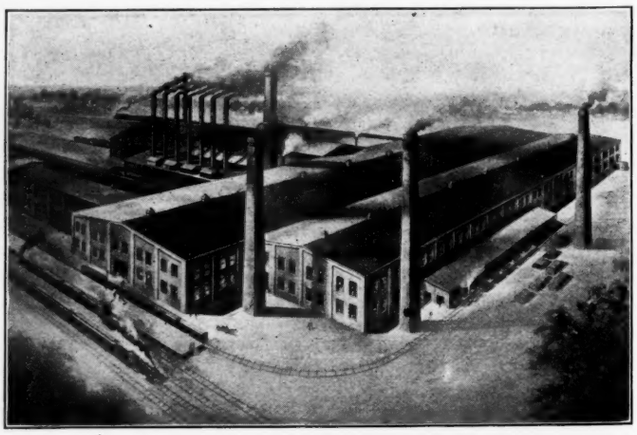
In operating the turbine, a practice is made of drawing a few buckets of oil from the tank every two weeks and adding the same amount of fresh oil; this seems to keep the oil in good condition. No trouble has been experienced in keeping the bearings cool, this being accomplished by means of circulating water. In order to maintain a uniform flow the water is taken direct from the mains and is passed through a reducing valve which takes care of any fluctuation in pressure in the main supply. The attention required by a turbine generator of this size is not as much as that demanded by one of the engine-driven units. Good results are obtained without the use of a receiver generator between the units and the turbine, as the reducing valve makes up for any deficiency in the steam supply.

The longest continuous run so far made with this turbine has been five days and nights. No shut-downs due to trouble of any kind with it have occurred since the turbine was first put in operation, and the Bettendorf Company can conscientiously recommend the installation of a low pressure turbine in any place where a sufficient supply of exhaust steam is available for its operation.

Ohio Seamless Tube Works.

The manufacture of seamless cold-drawn steel tubes in the United States is a comparatively new industry. The first tube factory for this purpose in America was built in the town of Shelby, Ohio, in 1889, and soon developed a successful and flourishing business. It passed into the hands of the United States Steel Corporation, and was destroyed by fire in 1908. Soon after this the Ohio Seamless Tube Company was organized, and the new tube works, here illustrated, were built on the site of the old Shelby factory. The local officers of the original concern became stockholders, and were given the management of the new company. The old employees also invested in stock and were employed, so that the large experience of both officers and workmen, which was obtained in developing the Shelby Tube Company, has been used to advantage in the management of the new company, and in the designing of the buildings and the machinery for the new works.

The seamless tube business now requires a wide variety of machinery for the manufacture of special work, such as is required for automobiles, locomotive, marine and stationary boiler tubes, and for the high-grade tubes required by the government. The cold drawing operation tends to harden the metal, and in order to adapt the tubes to their various uses they are annealed and cleaned of scale by pickling. The annealing process is varied according to the requirements of the user, and designated as soft, medium or hard anneal. The soft anneal is furnished where tubes are subjected to severe physical stress requiring ductility; the medium anneal where there is but little stress,



Ohio Seamless Tube Works, Shelby, Ohio.

and the hard anneal where rigidity or stiffness is required. Unless specially ordered, the cold drawn tubes are furnished with medium annealing. Where higher strength and elastic limit are required higher percentages of carbon are used in the tubes, and to meet exceptionally exacting conditions a nickel alloy is used up to 3½ per cent.

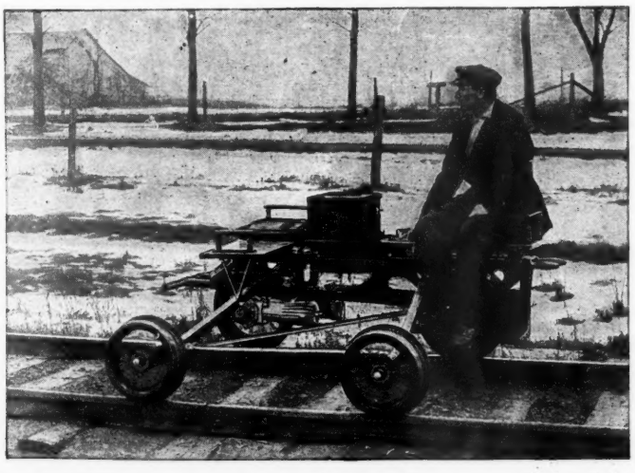
A. C. Morse, general manager of the Ohio Seamless Tube Company, was employed by the Shelby mill when it was first started, and he has grown up with the business, learning the process of manufacture in all its details. H. E. Brubaker, the present superintendent, also served with the Shelby company as an assistant under Mr. Morse. The capacity of the new plant

when working day and night gangs is normally about 1,000 tons, but this can be increased if necessary to 1,500 tons per month. The Ohio Seamless Tube Company carries a large stock of finished tubes in standard sizes, and this stock is available for all concerns that use tubing in small quantities, as well as large. The company makes a specialty of furnishing tubes for automobiles and mechanical purposes of all kinds, and has a complete equipment for doing this kind of special work.

New Motor Car.

A new Sheffield motor car in which many novel and interesting features are embodied is made by Fairbanks, Morse & Co., of Chicago. It is intended for all purposes where a small one to three man car is required. The frame is made of pressed steel, square steel tubing and steel stiffeners. The pressed steel members are made from one piece of steel, being stamped to the proper form, while in the flat sheet and then flanged and bent to the required shape. The necessary holes in the frame are drilled in a jig at one setting so that the frames are absolutely interchangeable. They have a decided advantage over those of wooden construction in that they are more easily braced, more durable, and if any part of the frame becomes bent it may be straightened and used again. The most important improvement in the car, however, is in the engine, which instead of driving the rear axle, the method usually adopted for this type of car, is arranged to directly drive the front axle, the cylinders and crank cases being partly under the frame of the car; the lower flange of the frame is sloped up towards the front to allow of this construction.

The engine has two cylinders, 3¼ in. x 4 in., and is of the two cycle, three port, air-cooled type. The cranks are enclosed so that there is no opportunity for dirt or sand to get into the



Sheffield Motor Car.

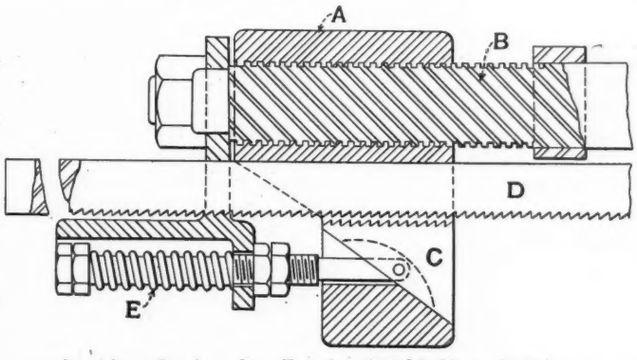
working parts, which materially increases the life of the engine. The use of the two cycle principle introduces several advantages which can not be obtained with an engine of the four cycle type. There are no valves of any kind, which does away with the springs, cams, chains, etc., which are necessary for their operation. This in itself reduces, by a large amount, the difficulties which ordinarily appear in such cars. Lubrication of the whole engine is accomplished by mixing the oil with the gasolene in the supply tank and allowing the mixture to pass through the carbureter to the crank case and cylinders, the oil entering as a spray while the gasolene is vaporized. This gives a thorough and economical lubrication to all parts of the engine and leaves no opportunity to burn out bearings, for as soon as the engine starts lubrication begins.

The car may be made for any gage over 24 in.; its wheel base is 3 ft. 10 in., and the length over-all is 7 ft. The wheels are 17 in. in diameter, with wooden centers. The car is controlled by levers on the seat, regulating the spark, throttle and the brakes. It will seat three persons and will run 30 miles per hour; the 4-h.p. engine consumes about 2¼ gallons of gasolene for each 80 miles. The total weight of the car is about 400 lbs.

Shop Equipment.

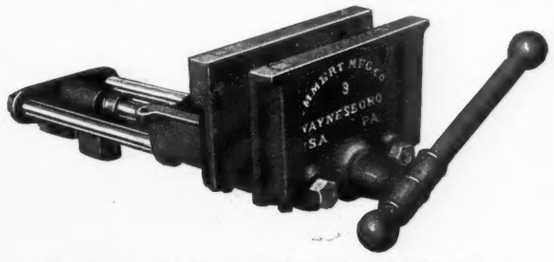
Quick Clamping Wood Vise.

The Eureka Rapid Transit vise, made by The Emmert Manufacturing Company of Waynesboro, Pa., is the result of three years of experimenting and investigating on rapid acting and securely locking vises for woodworkers. This vise is locked or unlocked automatically by simply turning the handle about one-quarter turn, either to the right or to the left. The essential



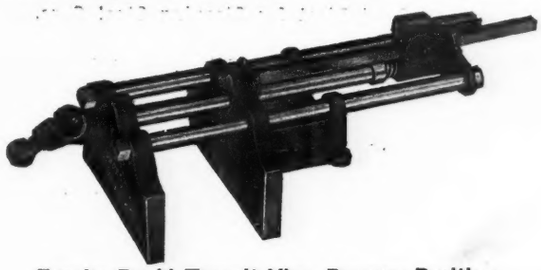
Locking Device for Eureka Rapid Transit Vise.

feature of these vises is this positive locking device which works on the screw B and engages with a case-hardened ⅝-in. square steel lock rod D, placed within 3/16 in. of the main screw of the vise. The nut A and the screw B have full threads which gives the vise the strength of a common screw vise. The lock rod passes through the nut and is gripped firmly on two sides, by the nut on one side, and the triangular shaped toothed wedge C, which is contained in the nut on the other. This wedge operates against a slanting surface in the nut, so that when the main screw of the vise is turned to the right the nut moves forward



Eureka Rapid Transit Vise, Upright Position.

lifting the toothed wedge directly upward, meshing it with the grip rod. This is accomplished without any pressure being applied to the main jaws of the vise. The toothed wedge and grip are of case-hardened steel and will wear indefinitely. After the toothed wedge has been forced into position, as described, the nut becomes rigid with the grip rod and may then properly be considered a part of the rear jaw of the vise. The screw then



Eureka Rapid Transit Vise, Reverse Position.

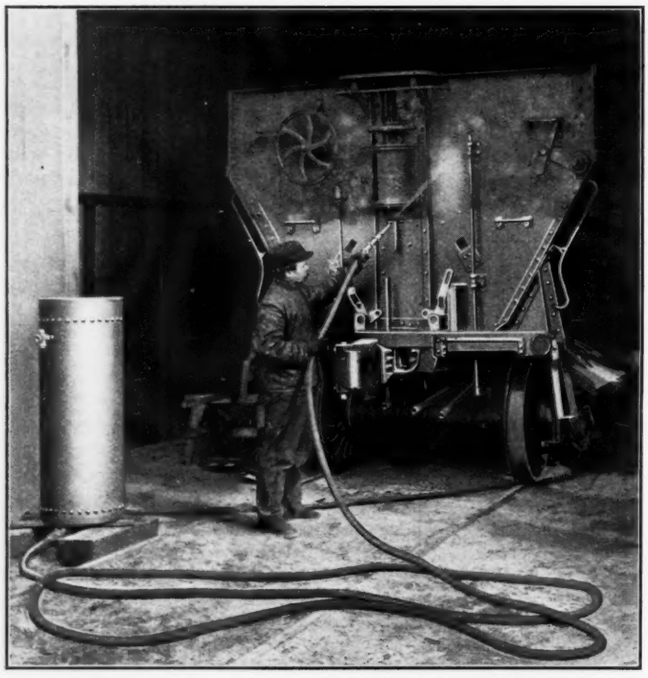
passes through the nut, drawing the front jaw inward against the work and compressing the spring E. The toothed wedge once in position cannot be displaced without reversing the screw and relieving the jaw pressure. This locking device has been

subjected to every possible test for more than a year and has never failed to give a positive lock and at the same time without any noticeable wear of the parts.

A tilting or angle jaw is provided for holding tapers or wedge like shapes. Each of the main jaws of these vises is provided with slotted holes so that a wood pad form may be attached to the angle jaw, and if a greater angle is desired this wood pad may be of a wedge shape. The vises are also provided with vise stops or holding dogs which are concealed within the vise jaw when not in use. The illustrations show the Eureka Rapid Transit Vise No. 130 in the upright and reverse position.

Sand Blast Apparatus.

The Mott sand blast apparatus as used by the Goodman Car Co. at Stickney, just outside of Chicago, is shown in the accompanying illustration. This apparatus is simple and economical. In the Goodman shop one man is able to clean three steel cars a day ready for the painter. The work, formerly done by hand, required fourteen men three days. The sand blast does the work more effectively because it leaves a clean, smooth surface, smoothing off all rusted places and getting into the corners around the bolt heads and rivets, where hand tools did not do effective work. The Mott apparatus will work with any air pressure, from five to one hundred pounds. The ninety pounds usually available in railway shops is more than is needed for economical work. The manufacturers, the Mott Sand Blast Mfg. Co. of Chicago, have made the price of the apparatus low, preferring to install more machines than to get a high price for a few. The Mott sand blast is also used to

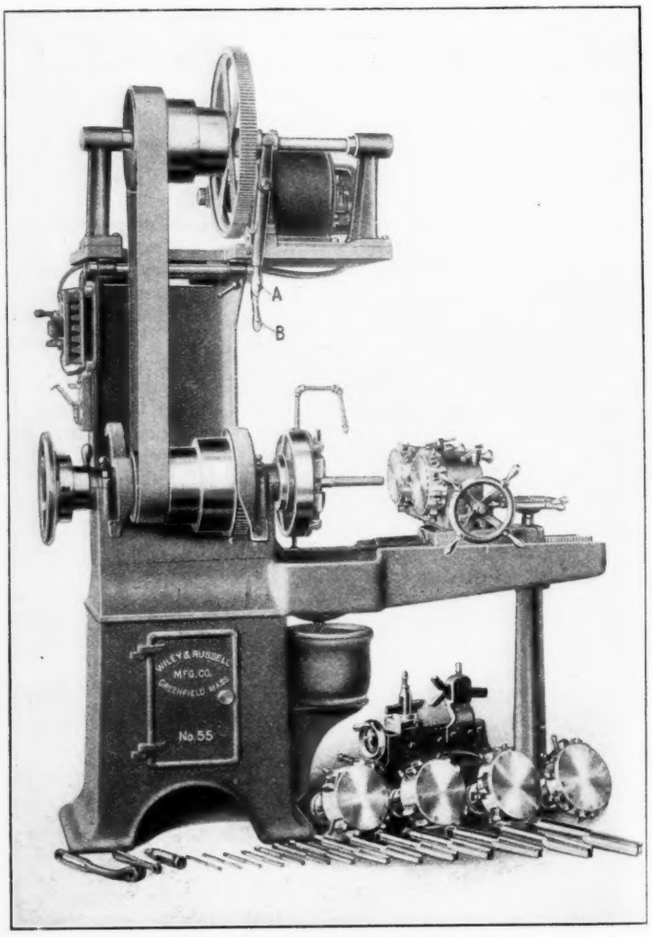


Mott Sand Blast for Cleaning Steel Cars.

clean steel bridges and the exposed frame work in steel buildings before painting. In cleaning steel bridges it is possible to take air pressure direct from locomotive air brake supply.

Opening Die Machine.

An interesting motor application to a standard combination opening die machine, made by the Wiley & Russell Manufacturing Company, Greenfield, Mass, is shown in the accompanying illustration. It is equipped with patented quick-change opening dies, and may be used as a bolt-cutter, nut-tapper, pipe-threader or cutting-off machine. The motor rests on a shelf secured to a bracket which is fitted and bolted to the bed of the machine. This shelf is hinged at the back, and has finished projecting lugs that rest on cams, which are operated by the lever A. By swinging this lever the shelf may be raised or lowered on the cams, giving the belt its necessary tension. This device is also useful when shifting the belt from one step to another. The lever B, in front of the motor, controls the clutch in the large spur gear, making it possible to stop the machine independently



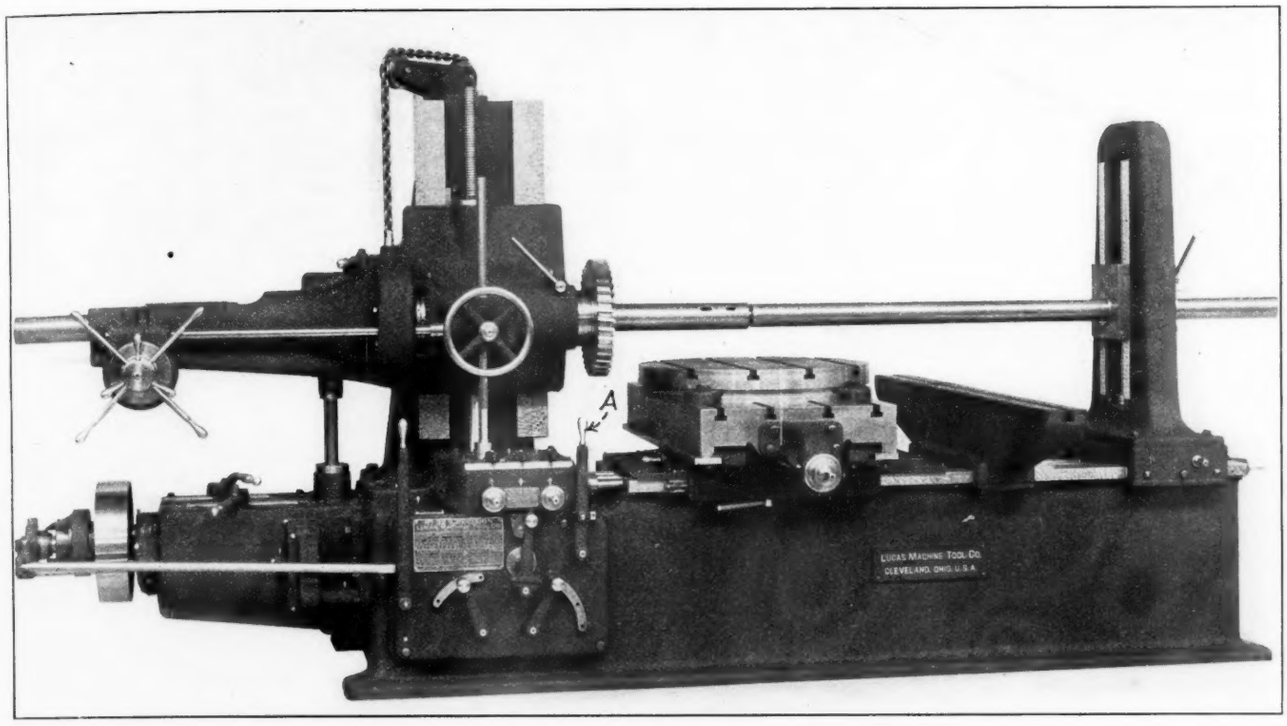
Combination Opening Die Machine.

of the motor. The 2-h.p. motor runs at constant speed, is backgeared and is fitted with a rawhide driving pinion. Reversing or non-reversing motors may be furnished for direct or alternating current. The arrangement is strongly and carefully constructed, and the machine is guaranteed to cut bolts and pipe up to 2 in. in diameter. The total weight of machine and motor is 2,300 lbs.

Cement for High Temperatures.

Engineers have experienced difficulty in the proper maintenance of brick settings of furnaces of all types and have been compelled to depend largely on the ordinary fire clay as a bonding material; as this fuses at a comparatively low temperature, the bond between the bricks is rapidly destroyed, opening up cracks in the walls which eventually cause it to collapse. Also refractory bricks become porous and clinkers from the coals soon form on the surface; in removing them the bricks are often broken.

After several years devoted to research work on refractory cements to overcome these troubles, the H. W. Johns-Manville Company, New York, are now offering to the trade a line of cements called J-M refractory cements, which are rated to resist temperatures as high as 3000 deg. F. These cements may be used for the following purposes: Furnace setting of various types, cupolas, lining brass furnaces, assayers' crucibles, oil burning, tilting and rotary furnaces, and for patching and facing bricks in place on the fire zone under various conditions. They have also produced a coating for walls known as J-M Brickline cement, which seals the pores of the brick and prevents clinkers from adhering to them. Realizing that there are variable con-

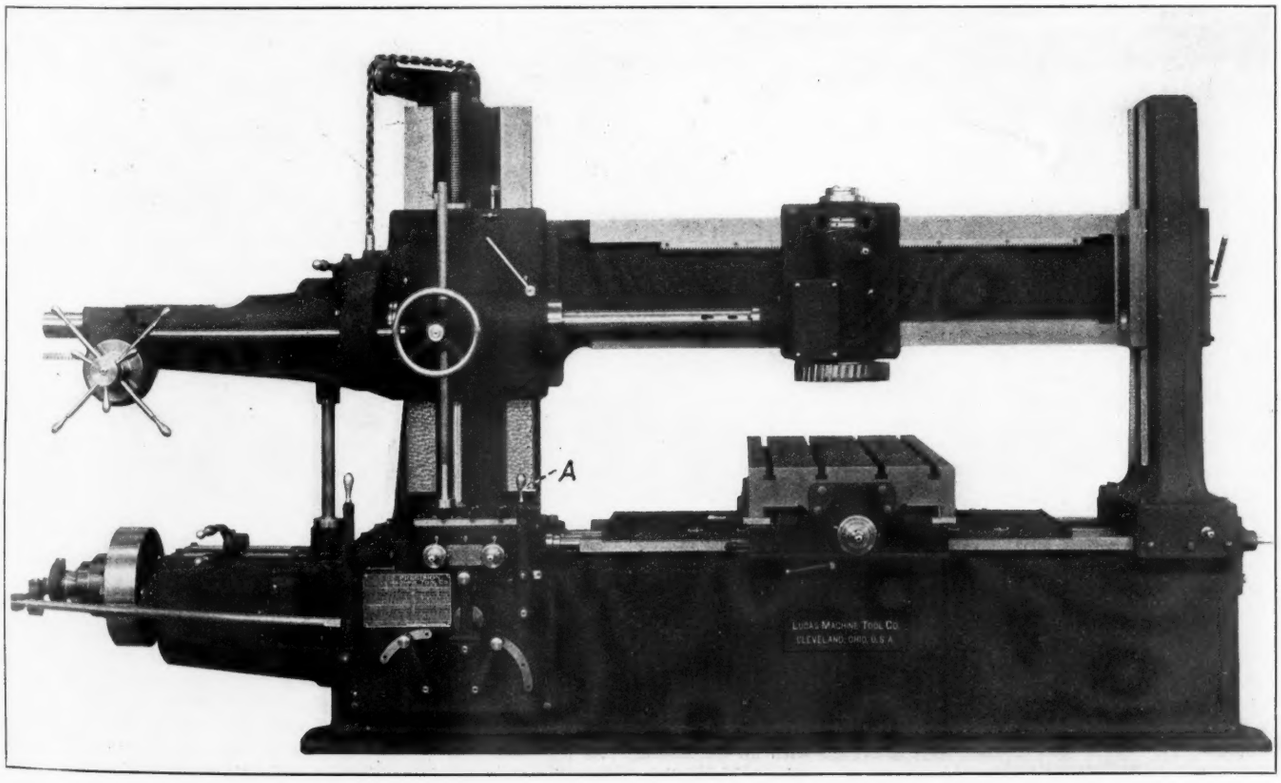


Lucas Precision Boring, Drilling and Milling Machine.

ditions under which these cements are used, they have been made so that they may be modified to meet conditions as they exist. The Johns-Manville Company will be glad to make a careful investigation into troublesome conditions, and offer suggestions tending to overcome the difficulties.

Precision Boring, Drilling and Milling Machine.

A boring, drilling and milling machine of new design and construction, and one that will find extensive use in railway shops, has recently been placed on the market by the Lucas Machine Tool Company, of Cleveland, Ohio. This machine, shown in the accompanying illustration, is the result of ten years of development and improvement. The feature that is common to all Lucas type machines is the raising and lowering of the spindle head which, being a constant weight, may be more accurately compensated for than the raising and lowering of the table with its great variety of loads. This feature gives the opportunity of properly distributing the metal to the best advantage. Its construction allows the use of a deep bed of great



Lucas Precision Boring, Drilling and Milling Machine Arranged as a Vertical Milling Machine.

stiffness which gives a solid foundation; the weight is so distributed that the machine may be satisfactorily operated without placing it on a foundation. The 24 in. x 48 in. platen is of extra size and weight, providing a large working surface of ample strength and rigidity. The greatest distance from the top of the platen to the center of the spindle is 24 in. The adjustable back rest which carries the tail block is well proportioned, and its base has liberal bearings on the bed of the machine. It may easily be removed from the base to accommodate extra long work without impairing the general rigidity of the machine. The spindle head and the tail block are raised and lowered together, being connected by a shaft and planed bevel gears. The tail block has long V bearings, which make it impossible for the back rest to spread, so that when the tail block and back rest are bound together, they become practically one piece. The spindle drive is transmitted, in the most direct manner possible, from the source of power to a gear of large diameter on the spindle sleeve. The back gears are on the head, where they should be, and are operated by a convenient lever.

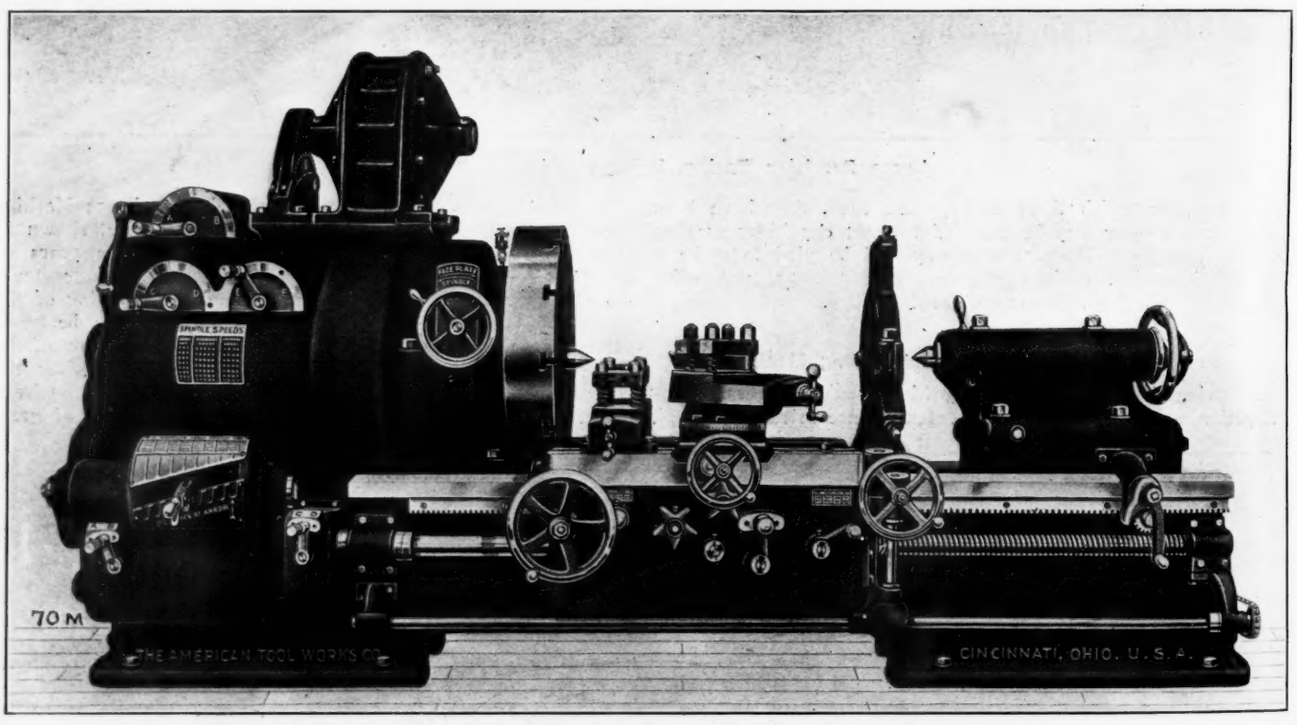
The principal feature in this machine, which differs from former machines, is the feed mechanism. It has a constant speed quick return which may be applied wherever the feed is being used. It is operated by the lever A which, when in the left-hand position, gives the quick return, and when in the right-hand position allows the feed to operate. The feed is operated by two levers controlling sliding gears and giving nine changes for either position of the spindle back gears, which gives a total of eighteen changes ranging from .004 in. to .600 in. per revolution of the spindle. These feeds may be applied to the spindle, spindle head and tail block, saddle and platen; they are so arranged that not more than one feed can be engaged at the same time. All feed screws are true to pitch, and are provided with dials graduated to read to thousandths of an inch, which allows the work to be done accurately and interchangeable parts produced without the use of jigs. The machine may be driven by belt or by a direct connected motor. If by belt, the speed should be such as to drive the 16 in. pulley on the machine 300 r. p. m.; if electrically driven, a 7½ h. p. constant speed motor running at 1,000 to 1,200 r. p. m. should be used. These speeds give the spindle a range of from 7½ to 150 r. p. m. The machine will take work 6 ft. long between the face plate and the outer support, and has a 36 in. cross feed provided with an automatic trip. Its total weight, skidded for shipment, is about 12,000 lbs.

The machine is also shown with a cross rail allowing it to be used as a vertical milling machine. The cross rail is bolted to the spindle head and the outer support. On it slides a head, carrying the verticle spindle which may be fed along the rail either by hand or power. The verticle spindle is constructed along the same lines as the horizontal spindle, which is of forged steel, and has a large taper front bearing. It runs in a solid bronze bushing in the solid head of the machine, with a collar between the shoulder on the end of the spindle and the end of the bronze bushing. This makes a solid construction, and a slight reduction in the thickness of the collar allows for any adjustment that may be necessary after long use. The rear bearing is straight, but the split bushing is taper on the outside, and can be adjusted by the locking nuts to compensate for all wear. Milling cutters of large diameters like the 12 in. cutter shown, may be bolted directly to the spindle flange. The combined movement of the head and platen gives this form of machine a wide range for surfacing work.

High Duty Lathes.

Although the high duty lathes here illustrated are strictly new in design, they are by no means in an experimental stage, as they have been installed in shops and have performed service that has exceeded the expectations of the makers, the American Tool Works Company, Cincinnati, Ohio. As an illustration of their capacity, a 20-h.p. motor is recommended for the electrically driven machines, and the makers guarantee that the lathe will work in continuous service without being strained with a 50 per cent. overload on the motor. The lathe is made specially heavy and the metal is placed where it is most needed to give the required rigidity, thereby overcoming the possibilities of chatter and vibration. The bed is of deep section and is thoroughly braced by cross box girths at short intervals throughout its entire length, and is further strengthened by a web cast through the center. The wall of the bed at the tailstock end is cut out to permit of slipping the tailstock off without taking out the bolts.

The lathe may be driven by motor or belt, the belt being applicable to both the geared head, with a single pulley, or to the regulation cone pulley. If motor driven a constant speed motor is recommended with a speed between 700 and 1,000 r.p.m., but if a variable speed motor is preferred, a speed variation of only 35 per cent. will be required, on account of the range of spindle speeds obtained from the gears in the headstock. The geared head is of the triple geared type and is connected to the main

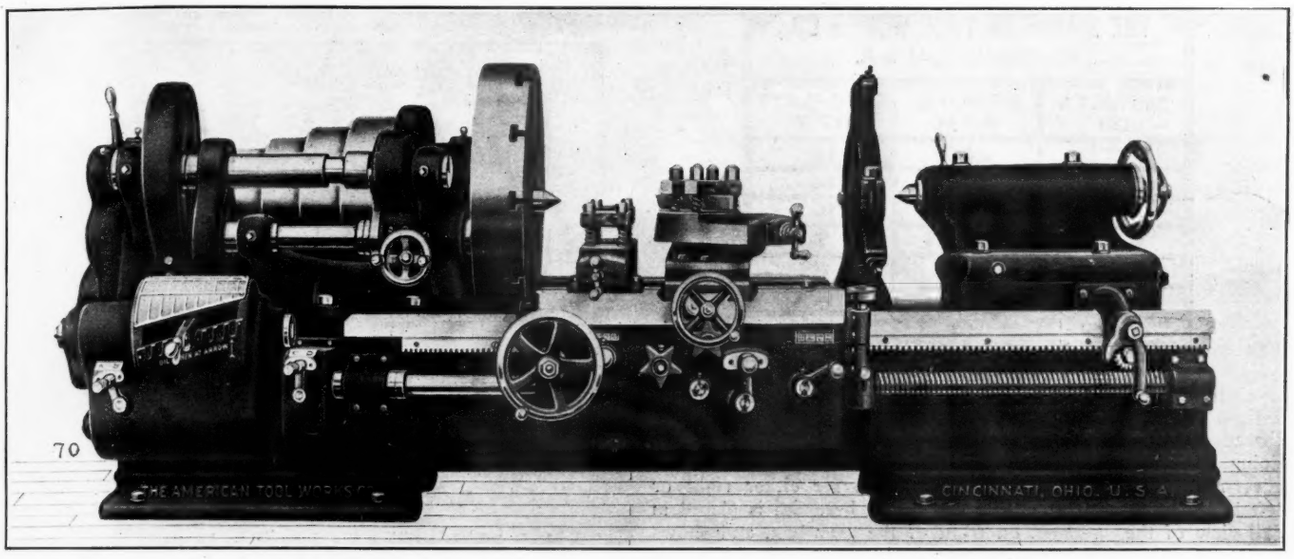


American High Duty Lathe, Arranged for Motor Drive.

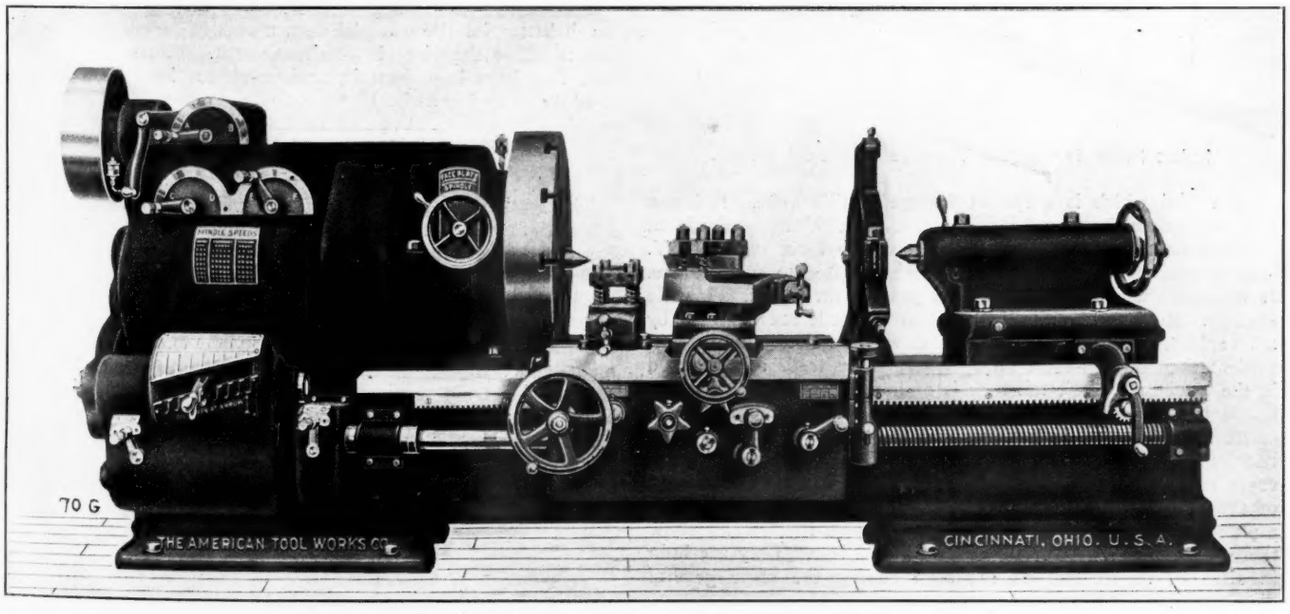
driving shaft through spur gearing. Sixteen spindle speeds are provided by means of positive clutches, of the "selective type," and slip gears, the teeth of which are rounded causing them to slide easily into mesh. Eight of these speeds are obtained directly through the spindle gear and the other eight through the face plate drive.

A sensitive but powerful friction clutch, the handle of which is shown to the right of the pulley in the illustration of the belt driven lathe, is provided, which facilitates making speed changes without shock to the parts. The gears are made with a coarse pitch and wide face and are all mounted on long bronze sleeves which are oiled by means of sight feed oilers from the outside of the head. All the driving is either done through short shafts, or sleeves, which eliminates the possibility of binding or chattering sometimes found in long shafts under excessive torsional stress. The spindle is made of high carbon, hammered steel in taper form, a construction common to heavy wheel lathes, and has only one gear which is set close against the front bearing. This arrangement adds greatly to the life of the bearings and the alinement of the spindle itself. Bearings throughout the head are all bored from the solid and are lined with massive phosphor bronze bushings. All speed changes may be made without stopping the initial drive of the machine, thus enabling the operator to quickly make the various speed changes. The positions of the levers for the various spindle speeds are plainly indicated on the index plate, a copy of which is shown herewith. This plate has been carefully worked out and the simplicity with which each spindle speed is obtained will be appreciated.

An important feature of the lathe, and one that was designed entirely on original lines, is the quick change gear mechanism. Forty-eight changes are provided for feeding or screw cutting, 32 of which are obtained by simply arranging the levers as directed by the index plate, and the others through a compound quadrant gear on the end of the bed. These different feeds are all obtained from the same driving speed, which feature gives this lathe a distinct advantage. The range of threads for screw cutting is from ½ to 28 threads per inch, including a 11½-in. pipe thread, and the range of feeds is from 4 to 224 cuts per inch, or just eight times the corresponding screw threads. The feed box is a complete unit, embodying what is usually carried in two sections, and consists of a gear box on front of the bed with two levers and a steel sliding tumbler, the latter working in conjunction with a cone of eight steel gears. The cone of the gears and the tumbler gear are of the Brown &



American High Duty Lathe, Arranged for Cone Pulley Belt Drive.



American High Duty Lathe, Geared Head.

Sharpe 20-deg. involute pointed tooth type, which provides a strong tooth and permits of instant engagement while running, without the gears riding on the top of one another before dropping into place. The clutches used are of the "selective type," making the engagement practically instantaneous. An important feature of this unit is the arrangement of gears so that coarse

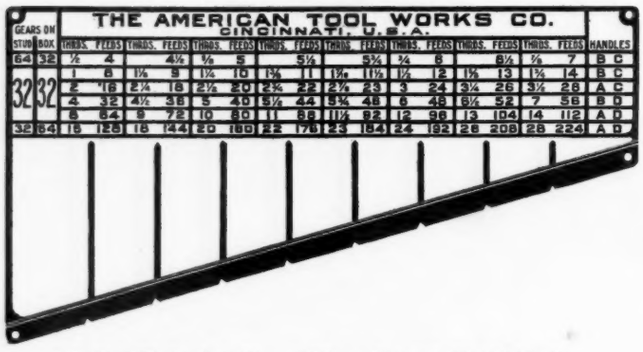
THE AMERICAN TOOL WORKS CO.,
CINCINNATI, U.S.A.

HANDLES ON	SPINDLE R.P.M.	FACE PLATE R.P.M.
A D E	250	19
B D E	180	14
A C E	130	10
B C E	95	7
A D F	70	5½
B D F	50	4
A C F	36	2¾
B C F	26	2

Index Plate for Spindle and Face Plate Speeds.

threads and feeds are all secured with the direct drive, thereby doing the heaviest work with the least amount of gearing. A reverse plate at the spindle gear arranges for either right or left hand threads. The index plate shown herewith is placed in full view of the operator, on front of the gear box, and shows the exact setting for each thread or feed.

The carriage is very heavy and is particularly deep, due to the

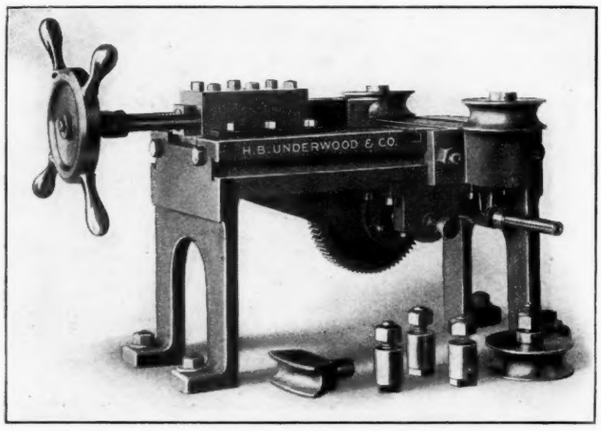


Index Plate for Screw Threads and Tool Feeds.

drop V bed which is a special feature in this lathe. It has a full continuous bearing of 50½ in. on the V and additional bearings on the top and inner surface of the front tail stock V. The apron is tongued, grooved and firmly bolted to the carriage. It is double which gives all shafts passing through it a double bearing. Both the longitudinal and cross feeds are reversed by a lever from the front of the apron, which is much more convenient than that in most lathes where these feeds are reversed in the headstock. The tailstock is of heavy construction, having ample bearing on the ways. It is moved along the bed by a crank and gear and is held in place by a pawl, engaging in a rack cast in the center web of the lathe, in addition to its quadruple clamping studs. It is provided with a taper attachment of the offset type which allows the compound rest to be set in a plane parallel to the bed. The accompanying illustrations show these lathes arranged for motor and belt drives. They are built in sizes of 36 in. and 42 in., both having the same general dimensions.

Power Bender and Straightener.

A machine for bending pipe, structural iron and round and flat bars of various kinds and sizes, has been developed by H. B. Underwood & Company, of Philadelphia, Pa. It is capable not only of bending, but also of straightening material in a quick and efficient manner. Instead of requiring a multiplicity of dies or formers, as in most machines, it is only necessary to have a set of formers for the different diameters. These may be set in different locations and permit of bending an infinite variety of shapes, as well as radii. Being belt driven, with a tight and loose pulley on the shaft, it is much more economical than compressed air, and may be used where the latter is not obtainable. A much greater power may also be brought to bear on the work. The ram is actuated by an eccentric shaft of small throw, which moves with a fixed stroke. This shaft is powerfully back-geared, giving the ram considerable power. Sliding in the ram is another shaft which carries the former to be used, and is moved in or out by a screw operated by the hand wheel. This gives a delicate means of adjusting the formers so the work may be bent to the exact shape, and any number of pieces may be bent to the same shape by noting the last position of the hand wheel.



Power Bender and Straightener.

But little skill is required to operate the machine; there is no complication, and by just moving the pipe along and turning the hand wheel the work is given the desired shape. The formers or resistance studs slide in a T slot on each edge of the bed. T slots are also placed across the bed so that the formers may be fastened therein, thus allowing many different arrangements. The effect of bending in this manner, by the former following up the work and exerting at each stroke a little more pressure, is much better for the material than a sudden severe bend, or trying to shape the piece in one movement. Pieces of pipe, bars, etc., that have been bent in various shapes have been straightened easily and quickly.

FOREIGN RAILWAY NOTES.

The section of the Cape to Cairo railway from Broken Hill, Rhodesia, north to the Star of Kongo mine in the Belgian Kongo has just been opened. At present the most northerly places of importance in the Kongo to which communication will be maintained are Elizabethville and the Star of Kongo mine, the latter on a branch line about seven miles from Elizabethville. The length of this extension from Broken Hill to the Kongo border is 132 miles, and thence about 60 miles to the Star of Kongo mine. A semi-weekly train service has been arranged for this extension, being continuations of the trains de luxe leaving Buluwayo, British South Africa, on Tuesdays and Fridays. The Belgian authorities are arranging for the further extension of the line to the north to open up the Kongo, and it is expected that a contract will be let for this work early in 1911.

A bill has been introduced in the Cuban congress for railway construction as follows: To authorize the Executive to grant a subvention not exceeding $9,500 per mile on the plain and $16,000 per mile in the Cordillera de los Organos, to the company which will build the following lines: (a) From Guanajay, connecting Cabanas, Bahia, Honda, Rio Blanco, La Palma, and Vinales with Pinar del Rio, (b) from Los Arroyos de Mantua, connecting Mantua, Montezuelo, Luis Lazo, Isabel Maria, and Cabezas with Pinar del Rio, (c) from La Palma, to connect with San Diego de los Banos and Paso Real de San Diego, Herradura and Dayaniguas, and (d) from Paso Real de Cuane, through the tobacco zone to Los Remates by way of Cayuco, Las Martinas, La Grifa, and La Fe.